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SOME FEW
GENERAL REMARKS
ON
FRACTURES
AND
DISLOCATIONS.

By PERCIVALL POTT, F.R.S.

AND

SURGEON to ST. BARTHOLOMEW'S-HOSPITAL.

*Navem agere ignarus navis timet ; abrotanum ægro
Non audet, nisi qui didicit dare. Quod medicorum est
Promittunt medici : tractant fabrilis fabri.*

HORAT.

L O N D O N :

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T O
Doct^r WILLIAM PITCAIRN,
Doct^r ANTHONY ASKEW,
A N D
Doct^r RICHARD TYSON,
P H Y S I C I A N S

T O
St. BARTHOLOMEW'S-HOSPITAL,

The following sheets are addressed as a small
testimony of the regard and esteem of
their

Sincere Friend, and

Very Humble Servant,

Percivall Pott.

TO

DOCTOR WILLIAM FITZGERALD
DOCTOR ANTHONY ALLEN

AND

DOCTOR NICHOLAS TESSON

THEY ALL ARE

OF

THE UNIVERSITY OF CAMBRIDGE

The following facts are submitted as a basis
for the study of the subject and of the
state of the art.

These facts are

very much improved

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O N

FRACTURES and DISLOCATIONS.

NO part of surgery is thought to be so easy to understand, as that which relates to fractures and dislocations. Every, the most inexpert, and least instructed practitioner, deems himself perfectly qualified to fulfil this part of the chirurgic art; and the majority, even of these, are affronted by an offer of instruction, on a subject with which they think themselves already so well acquainted.

This is also the opinion of a considerable part of the people. They regard bone-setting (as it is called) as no matter of science; as a thing which the most ignorant farrier may with the utmost ease become soon and perfectly master of; nay, that he may receive it from his father and family, as a kind of heritage. We all remember the great, though short-lived reputation, of the

late Mrs. Mapp. We all remember, that even the absurdity and impracticability of her own promises and engagements were by no means equal to the expectations and credulity of those who ran after her, that is, of all ranks and degrees of people, from the lowest labourer or mechanic, up to those of the most exalted rank and station ; several of whom not only did not hesitate to believe implicitly the most extravagant assertions of an ignorant, illiberal, drunken female savage, but even solicited her company, and at least seemed to enjoy her conversation.

The desire of health and ease, like that of money, seems to put all understandings and all men upon a level ; the avaritious are duped by every bubble, the lame and the unhealthy by every quack. Each party resigns his understanding, swallows greedily, and for a time believes implicitly the most groundless, ill-founded and delusory promises, and nothing but loss and disappointment ever produces conviction. Arts, trades, and manufactures are allowed to be learnt, in general, by those who have employed a proper quantity of time and attention in such pursuits ; and it seems most singularly unjust,

unjust, as well as untrue, to suppose that physical people are the only part of mankind who are all either so dull as not to be able to learn, or so profligately wicked as not to practise their art to the best of their judgment, and to the greatest possible advantage of mankind.—Surely there are, and always have been among us, as well as in all other classes, men truly able and perfectly honest; men, who well understand the science which they profess, and who practise it, not only with great ability, but with strict integrity. I cannot be supposed to say or to mean this as a vindication of every individual. Different men have different powers and capacities. The multitude with us, as with all ranks and degrees (not excepting any) will always be deficient. Advancements in knowledge will always be owing to the ingenuity and industry of a few particular people; but such advancements will always, in due time, more or less influence the rest. They have so done; and notwithstanding that there remains a great deal yet to be done, to bring surgery to that degree of perfection of which it is capable, yet, whoever will compare the

present practice of it with that of a very few years ago, cannot justly or with any degree of candor, withhold his commendation from his contemporaries.

I remember some years ago to have heard a judge from the bench tell a jury, that he believed a country bone-setter knew full as much, if not more of the matter of his own business, than any, the most eminent surgeon in the kingdom. I will not enter into a disquisition concerning the rightness of a judge's opinion. Perhaps his lordship might very little understand the thing concerning which he decided so peremptorily; without either injustice or partiality, I may certainly suppose him to have been a much more able lawyer than surgeon: and I believe it will also be allowed, that general reflections of this kind are, and must be, the consequences of a petulant attempt to be witty, rather than of conviction; and therefore, at best, are frivolous and idle. But, on the other hand, I am very willing to allow (what indeed I have already allowed) that many parts of surgery are still capable of considerable improvement; and this part perhaps, as much as, if not more than any, it being one of those
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in which a general observance of and rigid adherence to old prescribed rules, have prevented the majority of practitioners from venturing to think for themselves, and have induced them to go on in a beaten track, from which they might not only safely, but advantageously deviate.

The general doctrine relative to fractures is contained under the following heads, as parts of the treatment of them.

Extension.

Counter-extension.

Coaptation or setting.

Application of medicaments.

Deligation or bandage.

Position.

Prevention or relief of accidents.

This is the general arrangement of the subject by most of the writers on it, and a very just and proper one it is; but notwithstanding the parade of books under these various heads, much less alteration will be met with, since the times of Hippocrates, Galen and Celsus, than an inquirer might expect, or than the subject is capable of.

I must desire that what I have said may not be misconstrued. I do not mean that there are not, and have not at all times

been, men of particular ingenuity, who have deviated from the common methods, and have greatly improved the art; but still the common methods are the same, and the multitude of practitioners religiously follow them. Let me not therefore be charged with presumption or arrogance, if I say, that under almost every of the foregoing heads the practice is capable of considerable improvements; improvements which would show rationality and sense in the surgeon, and produce ease and convenience to the patient.

I am aware that some of my readers may be inclined to charge me with affecting to deviate from the commonly prescribed rules, and to contradict opinions, which a great length of time, and a long succession of writers have given sanction to.

“ quæ

“ Imberbes didicere, senes perdenda fateri,”

is a hard lesson sometimes to human vanity, and what requires some degree of candor to learn. But, on the other hand, if it was not now and then practised, I know not how such an art as surgery (whose basis is experience) could ever be improved. Our
ancestors

ancestors deserve our best thanks for the assistance which they have given us; where we find them to be right, we are obliged to embrace their opinions as truths; but implicit faith is not required from man to man, and our reverence for our predecessors must not prevent us from using our own judgments. Antient and modern are mere sounds, and can signify nothing in this case, unless with the former we can connect an idea of truth established and confirmed by time and experience, and with the latter that of demonstrable improvement upon what has gone before.

If what I have to urge is not capable of being verified, and confirmed by experience, it must sink into nothing; but if upon trial it shall be found by the majority, (as it has been by me and some others) to be not only true and practicable, but highly conducive to the ease and benefit of the afflicted, it ought to have as much weight, though delivered by a living writer, as if it had proceeded from the remotest antiquity: its use, not its date, should give it value. If practitioners since the time of Albucasis had been contented with his doctrine, and never had ventured to think for themselves, sur-

gery had not been what it now is, and its great merit would still have consisted in the multiplicity of its hot irons. In short, to such as think that we are seldom or never to deviate from the opinions and practice of those who have gone before us, I shall take the liberty of answering in the words of the great Mr. Locke, who says, “ the
 “ floating of other mens opinions in our
 “ brains makes us not one jot the more
 “ knowing, though they happen to be true.
 “ And beaten tracks lead those whose
 “ thoughts reach only to imitation, “ non
 “ quo eundem est, sed quo itur.”

Before I enter on the subject, the reader will give me leave to acquaint him, that it is by no means my intention to write a regular treatise on fractures, although I think the subject well deserving of, and even requiring one. I only mean to throw out a few hints, which I hope may prove intelligible and useful.

The first article in the general arrangement is extension; under which may also be comprehended the second, or counter-extension.

In

In order to accomplish this, we are directed, if the fracture be of the thigh or leg, to place the patient in a supine posture, and the broken limb in a straight one; then having the upper part of it held firm and steady, by proper assistants, we are ordered by means of hands, ligatures, lacs, or even in some cases by pieces of machinery, to make such an extension or stretching of the limb lengthways, as shall enable the surgeon to place the ends of the broken bone in as apt, that is, in as even a position, with regard to each other, as the nature of the fracture will admit.—This is a short description of what, in the vulgar phrase, is called setting a broken bone, and is most commonly a painful operation to the patient, a fatiguing one to the operator and his assistants, and what is worse, is in many instances found to be inefficacious; at least, not fully to answer the intention of the one, or the expectation of the other *.

Writers

* “ Instruments for extension are threefold; first, the
 “ surgeons hands, &c. secondly, funes & habénæ, a sort
 “ of bandage fit to pluck at, in order for extension;
 “ thirdly,

Writers in general are very precise and formal in the directions which they have given, for the due and proper accomplishment of this purpose. They have told us, that the extension should be made slowly and gradually ; and should be continued till the ends of the bone are separated from each other sufficiently, to admit of the fracture being set without risque of breaking off any points or inequalities, and to enable us to place them perfectly smooth and even. All

“ thirdly, there are organa & machinemata, engines
 “ used by us and invented by the ancients.”

WISEMAN.

The very mention of fumes, habenæ, organa and machinemata, implies a force exceeding that of mere hands. A degree of force, which in a fracture never can be wanted, if the limb be rightly placed ; a degree of force, which must in the nature of things do mischief ; and a degree of force, whose whole effect, however great, must cease immediately upon its being removed ; unless the fracture be particularly and luckily circumstanced.

There are not wanting instances of the muscles surrounding a bad though simple fracture having been torn by extension, and spasm and other mischief thereby produced. See cautions on this subject, laid down by many old writers, particularly by Galen and Albucasis.

All this, like many other of the preceptive parts of phyfic and furgery, is very pretty on paper, but not often found to be practicable in the chamber. The direction to continue the extenſion until the ends of the bones are at a certain diſtance, lengthways from each other, plainly implies a conſiderable degree of violence; the limb muſt by ſuch force be not only made longer than its fellow, or than nature ever intended it ſhould be, but this procruſtian method of lengthening it is ordered to be executed while the limb is in ſuch poſition as to put all the muſcles moſt on the ſtretch, and render them leaſt likely to yield to it. Now, not to ſay a word of the great probability of the points and edges of the fracture wounding the ſurrounding muſcles, or of ſuch wounds being more painful or worſe in their conſequences when inflicted on parts thus ſtretched, or of the addition that ſuch force muſt make to the laceration already neceſſarily made by the fracture; I ſay, not to mention a word of all this, can the method itſelf (without conſidering any accidental adjunct circumſtances) be practiſed in every fracture, or even in the majority of fractures? Will it be done properly by the
rude,

rude, the inattentive, and the ignorant? if attempted by such, will it not be, is it not, frequently productive of pain, tumefaction, inflammation, and extravasation; which are set to the account of the nature of the fracture, and to inevitable necessity? and when done ever so properly, will it, can it, in an oblique or splintered fracture, answer the purpose it is intended for, or produce a more happy coaptation?

Whence arise these evils? from whence proceed the difficulty and the so frequent disappointment?

In order to understand this rightly, let us for a moment consider, what is or ought to be meant by the terms extension and counter-extension, and why they become necessary: for if the greater part of the pain attending such method, and the frequency of disappointment, both to patient and surgeon, should be found to arise from this part of the process, and that such part can be either disused without prejudice, or altered with advantage, we ought to think ourselves happy in having it in our power to correct our error.

Neither extension nor counter-extension can ever be necessary, on account of the

mere fracture, considered abstractedly. The broken ends of the bone or bones are of themselves inactive, and if not acted upon by other parts they would always remain motionless. When any attempt is made to put them into motion, they of themselves can make no possible resistance, nor can any be made on their part, save an accidental one arising from the points of the fracture being entangled with each other; and when they have been once, by the hand of the surgeon, placed properly and evenly with regard to each other, they would of themselves for ever remain so. What then is the reason why fractured bones always suffer a greater or a less degree of displacement? why is a broken limb almost always shorter than its fellow? what creates the resistance, which we always find in attempting to bring the fractured parts aptly together? whence does it proceed, that when we have done all that is in our power (according to this mode of acting) the ends of the fracture will in many cases become again displaced, and lameness and deformity frequently ensue? In short, what are the parts or powers which act on the bones, and which

which by so acting on them produce all these consequences ?

These parts are the muscles, the only moving powers in an animal body. By the action of these on the bones all locomotion is performed, and cannot be performed without them : and although all bones, when broken, are in some degree displaced and shortened, yet it will always be found, that in proportion as the muscles surrounding or in connexion with a bone are strong or numerous, or put into action by inadvertence or spasm, so will the displacement of the ends of such bone, when fractured be. The even and smooth position of the fractured ends of a tibia, when the fibula of the same leg is entire and unhurt, that is, when the muscles therefore cannot act upon the former ; the visible and immediate deformity, when both the before-mentioned bones are broken nearly in the same place ; that is, when the muscles can act upon and displace such fracture ; the great difficulty frequently met with, in endeavouring to get a broken os femoris, to lie even tolerably smooth, and to prevent such broken limb from being much shorter than the other,

are,

are, among others which might be produced, such strong and irrefragable proofs as need no comment.

From the muscles then, and from them only, proceeds all the difficulty which we meet with in making our extension, and by the resistance of these, and of these only, are we prevented from being always able to put the ends of a fractured bone immediately into the most apt contact.

Let us in the next place consider, what it is which gives to a muscle, or to the principal muscles of a limb, the greatest power of resisting any force applied to them ab externo, in order to draw them out into greater length; for whatever that is, the same thing will be found to be the cause of the different degrees of resistance in setting a fracture.

Does not the putting the muscles in a state of tension, or into a state approaching nearly to that of tension, almost necessarily produce this effect? or, in other words, does not that position of a limb, which puts its muscles into or nearly into such a state, give such muscles an opportunity of exerting their greatest power either of action or of resistance? This I believe cannot be denied.

nied. On the other hand, what is the state or position of a muscle which is most likely to prevent it from acting, and to deprive it most of its power of resistance? or what is that position of a limb, which in the case of a broken bone will most incapacitate the muscles from acting on and displacing it, and in the greatest degree remove that resistance which they have it in their power to make to the attempts for the reduction of such fracture? Is it not obvious, that putting a limb into such position as shall relax the whole set of muscles belonging to or in connexion with the broken bone, must best answer such purpose? Nothing surely can be more evident: if this be granted, will it not, must it not follow, that such posture of a broken limb must be the best for making the reduction; that is, it must be that in which the muscles will resist the least and be least likely to be injured, that in which the broken bone will be most easily set, the patient suffer least pain in present, and that from which future lameness and deformity will be least likely to happen. A little attention to what frequently occurs, may perhaps serve to illustrate and confirm this doctrine better than mere assertion.

What

What is the reason why no man, however superficially acquainted with his art, ever finds much trouble in setting a fractured os humeri, and that with very little pain, and a very small degree of extension? Is it not because both patient and surgeon concur in putting the arm into a state of flexion; that is, into such a state as relaxes all the muscles surrounding the broken bone? and is it not for the same reason that we so very seldom see (comparatively speaking of this bone with others) a deformity in consequence of a fracture of it? Let the reduction be attempted with the arm extended from the body, and the difficulty of setting will be much increased: let the arm be deposited in an extended straight position, and the fracture will be displaced and lie uneven.

Apply the same kind of reasoning to the os femoris; that bone whose fracture so often lames the patient, and disgraces the surgeon.

Will it not be more cogent, and more conclusive, in proportion as the muscles in connexion with this bone are more numerous and stronger? I would ask any man who has been much conversant with accidents of this kind, what is the posture
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which almost every person whose os femoris has been newly broken puts himself into, in order to obtain ease, until he gets proper assistance? Do such people stretch out their limb, and place their leg and thigh straight, and resting on the calf and heel? I believe seldom or never. On the contrary, do not such people almost always bend their knee, and lay the broken thigh on its outside? and is not the reason, why this must be the most easy posture, obvious?

From want of attention to, or from not understanding these few self-evident principles, many people permit their patients to suffer considerable inconvenience, both present and future.

It is a maxim universally taught and received, that a fractured limb may be in such state, as not to admit of the extension necessary for its being set; that is, if assistance be not at hand when the accident happens, if they who bring the patient home do it so awkwardly or rudely as to bruise and hurt the part, if from drunkenness, folly or obstinacy in the patient, it happens that the limb is so disordered that it is found to be much swollen, inflamed
and

and painful, it is allowed not to be in a state to admit extension.

This, I say, is a general maxim, and founded upon very just principles ; but what is the general practice in consequence of it ? It is, to place the limb in an extended, straight position, to secure it in that, and then by proper means, such as fomentation, pul-tice, &c. to endeavour to remove the tension and tumor. Now if it be considered that the swollen, indurated, and inflamed state of the muscles is the circumstance which renders extension improper, surely it must be obvious that such position of the limb, as necessarily puts these very muscles in some degree on the stretch, must be a very improper one for the accomplishment of what ought to be aimed at. Under this method of treatment, the space of time which passes in the removal of the tension is sometimes considerable, so considerable that a happy and even coaptation becomes afterwards impracticable ; and then this accident, which nine times in ten is capable of immediate relief, is urged as an excuse for unnecessary lameness and deformity.

How then are we to conduct ourselves in such circumstances ? The nature of the com-

plaint points out the relief. Extension is wrong; a straight position of the thigh or leg is a degree of extension, and a still greater degree of it in proportion as the muscles are in such circumstances as to be less capable of bearing it. Change of posture then must be the remedy, or rather the placing the limb in such manner as to relax all its muscles, must be the most obvious and certain method of relieving all the ills arising from a tense state of them: which change of posture will be attended with another circumstance of very great consequence; which is, that the bones may in such posture be immediately set, and not one moment's time be thereby lost; a circumstance of great advantage indeed; for, whatever may be the popular or prevailing opinion, it is demonstrably true, that a broken bone cannot be too soon put to rights; as must appear to every one who will for a moment consider the necessary state of the muscles, tendons and membranes surrounding, and the medullary organs contained within a large bone broken and unset; that is, lying in an uneven irregular manner. Can any truth be more clear, than that if the fracture, tension and tumefaction

mesaction be such that the muscles cannot bear to be stretched out in the manner necessary for setting the broken bone, without causing great pain, and perhaps bringing on still worse symptoms, the more the position of that limb makes its muscles approach toward a state of tension, the less likely it must be that such symptoms should remit, and the longer it must be before the wished-for alteration can happen; and consequently, that while the accomplishment of such purpose is by every other means aimed at, the position of the limb ought most certainly to contribute to, and not to counteract it? In short, if the experiment of change of posture be fairly and properly made, the objections to immediate reduction, from tension, tumour, &c. will most frequently be found to be groundless, and the fracture will be capable of being put to rights, as well at first as at any distance of time afterward.

Extension having been made, and the broken ends of the bone having been placed as smooth and as even as the nature of the case will admit, the next circumstance to be attended to is the application of some medicament to the limb; particularly to the

fractured part of it. In this, different people act differently. Some make use of an adhesive, or what they chuse to call a roborant plaster; some, of what is commonly called a cere-cloth; others apply spirit. vini with oil, vinegar and white of egg; and others the spirit. mindereri, the solution of crude sal ammoniac in vinegar and water, or some such kind of medicine.

To the cere-cloth, provided it neither sticks to the skin, nor is capable of irritating it, there can be no objection; neither can there be any to all the others, except the adhesive plaster; that must for ever be wrong upon every rational principle. The intention in applying any kind of external medicine to a broken limb is, or ought to be, to repress inflammation, to disperse extravasated blood, to keep the skin lax, moist and perspirable, and at the same time to afford some though very small degree of restraint or confinement to the fracture, but not to bind or press; and it should also be calculated as much as possible to prevent itching, an herpetic eruption, or an erysipelatous efflorescence. Adhesive plasters of all kinds, let the composition of them be what it may, are from this one quality the
least

least likely to contribute to any of the good ends proposed, and the most likely to be the cause of the contrary inconveniences, which ought most carefully to be avoided. They obstruct perspiration, they heat the skin, they produce itching, eruption and inflammation; and if the fracture be quite surrounded by them, and the limb be from any cause ever so little inclined to swell, they make a tight, painful and pernicious stricture; much greater even than a roller, and less likely to relax. At St. Bartholomew's hospital we use a cerate made by a solution of lytharge in vinegar, which with soap, oil, and wax, is afterward formed into such consistence as just to admit being spread without warming.

This lies very easy, repels inflammation, is not adherent, comes off clean, and very seldom if ever irritates or causes either herpes or erysipelas. But let the form and composition of the application made to the limb be what it may, one thing is clear, viz. that it should be put on in such manner as that it may be renewed and shifted as often as may be necessary, without moving the limb in any manner; it being certain, that when once a broken thigh or leg

has been properly put to rights, and has been deposited properly on the pillow, it ought not ever to be lifted up or moved from it again without necessity, until the fracture is perfectly united; and it is as true, that such necessity will not very often occur. This may perhaps seem strange to those who are accustomed to roll simple fractures, and consequently to lift them up every three or four days, in order to renew such kind of bandage: but the necessity of this motion arises merely from the kind of bandage made use of, and not from any circumstance of the fracture itself. That the frequent motion of a fractured limb cannot possibly contribute to the ease of the patient, will, I suppose, be readily admitted; as I suppose also it will, that when a broken limb has been once deposited in the best position possible, it is impossible to mend that position, merely by taking such limb up and laying it down again; from whence it must follow, that such kind of apparatus as necessitates the surgeon frequently to disturb the limb, cannot be so good as one that does not; provided the latter will accomplish the same kind of cure as the former: the truth of which position will appear in
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the most satisfactory manner to any who will take a view of the method in which simple fractures are treated at the before-mentioned hospital. Such application having been made as the surgeon thinks right, the next thing to be done is to put on a proper bandage.—That used by the ancients and by the majority of the present practitioners, is what is commonly called a roller. This is of different length, according to the surgeon's choice, or as it may be used in the form of one, two or more pieces. Hippocrates used three *, Celsus six ; but the present people seldom use more than one. By such kind of bandage three intentions are aimed at, and said to be accomplished, viz. to confine the fracture, to repress or prevent a flux of humours, and to regulate the callus † : but whoever will reflect seriously

* See on this subject Fab. ab Aquapendente, Wiseman, Scultetus, Hildanus, Petit, Du Verney.

† “ On applique la premiere sur l'endroit meme de la fracture. Son milieu doit repondre au centre. On fait trois tours circulaires : ce qui sert a affermir cet endroit, qui est le seul, qui ait besoin d'etre assujetti, comme etant le seul qui peut se deranger, & a contenir le suc nouricier & empêcher, qu'il ne s'echappe trop abondamment & trop irregulierement a l'entour de la fracture ; ce qui feroit un cal tres difforme.”

DU VERNEY.

ously on this matter will soon be convinced, that although some sort of bandage is necessary in every simple fracture, as well for preserving some degree of steadiness to the limb, as for the retention of the applications, yet none, nor neither of these three ends can be answered merely, or even principally, by bandage of any kind whatever: and therefore if this should be found to be true, that is, if it should appear that whatever kind of deligation be made use of, it cannot be a principal, but only an accessorial kind of assistance, and that in a small degree and very little to be depended upon, it will follow, that such kind of bandage as is most difficult to be applied with justness and exactitude, such as is soonest relaxed and out of order, such as stands most frequently in need of renewal, and in such renewal is most likely to give pain and trouble, must be more improper and less eligible than one which is more easily applied, less liable to be out of order, and which can be adjusted without moving the limb.

The ancient method of applying the roller in case of simple fracture of the leg or thigh, was to make * four or five turns round
round

* See a particular account of this in *Fab. ab Aquapendente*, and in *Serjeant Wiseman*.

round the fracture first, and then to continue the bandage upward and downward, until the whole limb was enveloped properly. This was done in this manner with a double view ; to keep the broken ends of the bone in their place, and to prevent the influx of humour. Modern practitioners, although they have the same ends in view, generally begin their bandage from the inferior extremity of the limb, and continue it up to the top. Whether the old or the later method be followed, whether one or more rollers be made use of, the whole is executed while the limb is kept by means of the assistants in the same extended posture in which the coaptation was made, so that the whole bandage is finished before the leg is deposited on the pillow ; in the doing all which, if from the tired state of the surgeon *, or either of his assistants, or if from the awkwardness or unhandiness of any

* The extraordinary length of time used by some in putting a fracture to rights, renders what I have called the *tired state of the assistants* an object of importance. The good position of the fracture depends as much or more on them than on the surgeon. If the assistant who holds the foot varies from the proper manner, I defy the surgeon to redress the fracture without the concurrence of such assistant.

any of the parties concerned, the true and exact position of the limb be at all deviated from, the ends of the bone will again be in some degree displaced, and the bandage instead of being of use will become prejudicial, by pressing hard on the inequalities of the fracture : to which let me add, that the roller, especially when applied to a leg, if it be not put on with due dexterity, that is, if it does not set perfectly smooth and even, is the most unequal and worst kind of bandage in use.

These objections, however just, are not the least to which the roller in the case of simple fracture of the leg or thigh are liable ; for, as I have already hinted, it must in a very short space of time, even while the parts surrounding the fracture are in the most tender and most painful state, be renewed, and that more than once ; which renewal cannot be executed without again taking the limb off from the pillow, again committing it to the hands of assistants, and again running a risque of displacing the fracture : all which, not to mention the repetition of pain to the patient every time such operation is performed, and which must be at least every four or five days, are
(as

(as I have already said) very material objections to the roller, even in the most judicious and dexterous hands, and still more so in those of the rude and ignorant.

The prevention of a flux of humors to a broken limb, by bandage, is a common phrase ; but they who use it have either no idea at all annexed to it, or a very erroneous one.

If by the points and edges of the broken bone the muscles and membranes be unavoidably wounded and torn, or if the same kind of mischief be incurred by the inadvertence or indiscretion of the patient, or of those who assisted in getting him home, or from the violence used in extending the limb and setting the fracture, inflammation must be excited, and pain and tumefaction will be the consequence ; and these will continue for some time in every fracture ; but that space will be longer or shorter in different cases and under different circumstances : evacuation, rest, and a favourable position of the limb will, and do in general, remove all these complaints ; but bandage can contribute nothing more than by keeping the applications in their proper place ; so far from it, that if the bandage be a roller it must,

must, by the frequent necessity of its being adjusted, and the frequent motion of the limb, in some degree counteract the proper intention of cure.

The old writers are in general very precise as to the number of days during which the roller should be suffered to remain without being shifted, and the number of times which such shifting should be repeated within the first fortnight *. This exactitude is by no means necessary; but if the bandage be supposed to be of any use at all, it is obvious, that it ought to be renewed or adjusted as often as it may cease to perform the office for which it is designed, or whenever it shall be found to counteract such office, that is, as often as it shall become so slack as not to contain the fracture at all, or whenever the limb shall be so swollen, that the roller makes an improper degree of stricture; the former generally occurs every
four

* “ Tertio die a deligatione facta, Hippocrates fascias
“ resolvit, &c. Facta bona deligature & pruritu non in-
“ sectante, a tertio usque ad septimum oportet ægrum
“ deligatum detinere.

“ Septimo membrum rursus solvendum perfundendum
“ aqua tepida & ligandum.”

Fab. ab Aquapendente.

four or five days, the latter is most frequent within the first week.

In most of the writers on the subject of fractures, we also find marks or signs laid down for our information concerning the due or undue effect of the bandage on the limb. They tell us, that when that part of it which is below the termination of the roller does not swell at all, that the bandage is not sufficiently strict, and will not retain the fracture; that when the same part is considerably swollen, or tense, or inflamed, it implies, that the binding is too strait, and that a moderate degree of tumefaction is a sign that the deligation is properly executed*.

* See on this Fab. ab Aquapendente, who speaks or rather copies the sentiments of Hippocrates and Celsus.
 “ Terminus in stringendo debet esse bona laborantis tole-
 “ rantia: ut deligatum leviter premat, & sic tum conti-
 “ neat & stabiliat fracturam, tum humores exprimat.
 “ Sunt etiam alia hujus signa, quæ altero die apparent;
 “ si enim æger eo die quo deligatus sentiat se valentius
 “ stringi, postero vero die tumor laxus, mollis & parvus
 “ appareat, bona est deligatio, quia jam humores a parte
 “ fracta sunt expressi. Si vero aut nullus tumor aut mag-
 “ nus & durus postridie in manu vel pede appareat, prava
 “ est deligatura; quia illa non continet hæc vero nimis
 “ arcta est & inflammationem movet. Id notandum fas-
 “ cias

In consequence of these precepts, many practitioners look more anxiously after this degree of tumefaction, than after the true and exact position of the limb, and cannot be induced to believe, that any thing can be wrong under this appearance ; although if they would for once assume the liberty of thinking for themselves, they might be convinced, that even this degree of swelling is wrong, that it implies some kind of obstruction to the circulation, and cannot serve any good purpose ; and consequently that as far as it may be supposed to be the effect of bandage, so far that bandage must be faulty.

The third purpose for which the roller is said to be used, is the regulation and restraint of the callus.

If we were to form our notion of callus by what the generality of writers have said on this subject, we should suppose, that it was not only a particular juice always ready for the purpose, but that, if not restrained and regulated by art, it would always flow in such quantity, as to create trouble and deformity ;

“ cias magis stringi debere in parte fracta, quam alibi,
 “ ut pars fracta magis illæsa servetur, ab humorum de-
 “ fluxu.”

deformity; that there were specific remedies for increasing or decreasing it, and that it always required the hand and act of surgery to manage it. That the callus is so far a particular juice, as that it consists of whatever is destined to circulate through the bones for their particular nourishment, is beyond all doubt; and that this gelatinous kind of fluid is the medium by which fractures are united is as true; but that it requires art to manage it, or that art is in general capable of managing and directing it, is by no means true. That this callus or uniting medium does oftentimes create tumefaction and deformity, or even lameness, is true also; but the fault in these cases does not lie in the mere redundance of such juice; it is derived from the nature of the fracture, from the inequality of it when set, and from the unapt position of the broken ends with regard to each other; nor is surgery or the surgeon any otherwise blameable in this case, than as it was, or was not originally in their power to have placed them better. It is the inequality of the fracture which makes both the real and apparent redundance of callus, and the tumefaction in the place of union. When a

D

bone

bone has been broken transversely, or nearly so, and its inequalities are therefore neither many nor great, when such broken parts have been happily and properly coaptated, and proper methods have been used to keep them constantly and steadily in such state of coaptation, the divided parts unite by the intervention of the circulating juice, just as the softer parts do, allowing a different space of time for different texture and consistence. When the union of a broken bone under such circumstances has been procured, the place where such union has been made will be very little perceptible, it will be no deformity, nor will it occasion any inconvenience. It will indeed be discoverable, like a cicatrix of a wound in a softer part, but there will be no redundancy of callus, because none will be wanted; neither will there be any necessity for any particular management on the part of the surgeon, to repress or keep it in order: But when a bone has been broken very obliquely or very unequally, when the parts of a fracture are so circumstanced as not to admit of exact coaptation, when such exact coaptation as the fracture perhaps would have admitted has not been judiciously made, when from unmanageableness,

ness, inadvertence or spasm, the proper position of the limb has not been attended to or preserved, in all such cases there must be considerable inequality of surface; there must be risings on one side and depressions on another; and in such cases the juices circulating through the bone, cannot accomplish the union in the same quantity, the same time, or in the same manner. The broken parts not being applied exactly to each other, there cannot be the same aptitude to unite; and according to the greater or lesser degree of exactitude in the coaptation, that is, according as the ends of the bones are or have been placed more or less even with regard to each other, will the inconvenience and the deformity be; and still most where the fracture is not set at all, but the broken ends of the bone unite laterally, or by touching each other's sides. The reason of all this is so obvious, without having recourse to a particular specific juice under the name of callus, that it would be an insult upon the reader's understanding to explain it farther *. The periosteum covering every

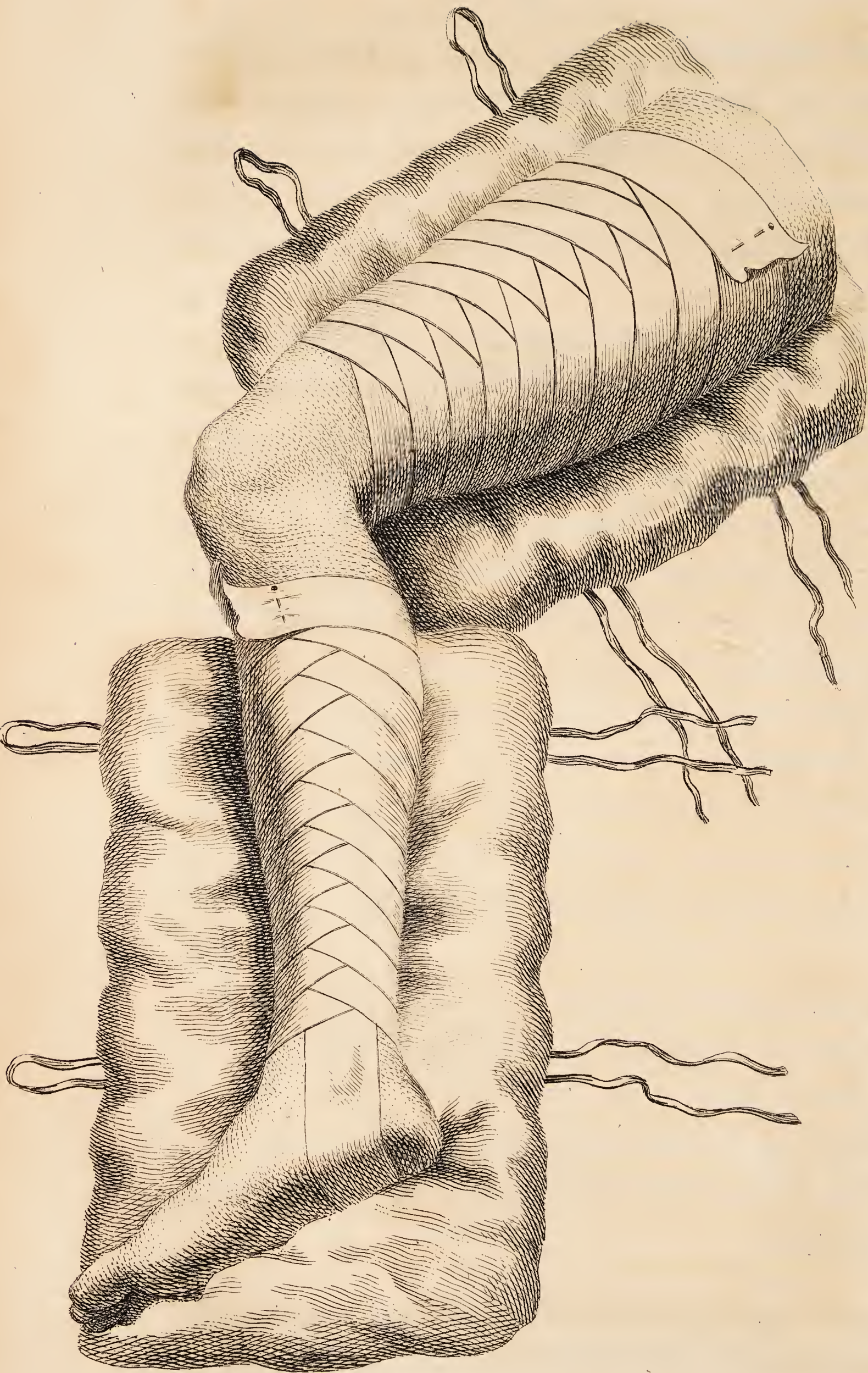
* On the subject of callus, the editor of Du Verney tells a story from Galen, and which himself seems not to

every fracture, will remain thickened for some time, and a degree of fulness or rising will be thereby caused about the place where such fracture has been united, but time, and the use of the muscles, soon in general remove this.

In short this doctrine of callus, considered as a particular kind of juice, and as being liable to great redundance if not prevented by art, has not only misled many people, but has often been made use of as a cover to ignorance and neglect. When lameness and deformity have been the consequences of one or both these causes, more than of the nature and circumstances of a fracture, the callus has been found ready at hand to take the blame, and the ideal exuberance of this cement has often been urged, as an excuse for real want of knowledge, or for gross neglect.

The best and most useful bandage for a simple fracture of the leg or thigh, is what is commonly known by the name of the eighteen-tailed bandage, or rather one made on the same principle, but with a little difference

disbelieve, viz. that a callus in a particular case, was so redundant as to transude through the skin, and to keep the compresses constantly wet.



ference in the disposition of the pieces. The common method is to make it so, that the parts which are to surround the limb make a right angle with that which runs lengthways under it; instead of which, if they are tacked on so as to make an acute angle, they will fold over each other in an oblique direction, and thereby fit more neatly and more securely, as the parts will thereby have more connection with and more dependance on each other. In compound fractures, as they are called, every body sees and acknowledges the utility of this kind of bandage preferable to the roller, and for very obvious and convincing reasons, but particularly because it does not become necessary to lift up and disturb the limb every time it is dressed, or every time the bandage loosens.

The pain attending motion in a compound fracture, the circumstance of the wound, and the greater degree of instability of parts thereby produced, are certainly very good reasons for dressing such wound with a bandage, which does not render motion necessary; but I should be glad to know what can make it necessary, or right, or eligible, to move a limb in the case of

simple fracture? what benefit can be proposed by it? what utility can be drawn from it? When a broken bone has been well set, and the limb well placed, what possible advantage can arise from moving it? surely none; but, on the contrary, pain and probable mischief. Is it not the one great intention, to procure union? Can moving the limb every two or three days contribute to such intention? must it not on the contrary obstruct and retard it? Is not perfect quietude as necessary toward the union of the bone, in a simple as in a compound fracture? It is true, that in the one there is a wound which requires to be dressed, and the motion of the limb may in general be attended with rather more pain than in the other; but does motion in the simple fracture give ease, or procure more expeditious union?

Every benefit then which can be supposed to be obtained from the use of the common bandage or roller is equally attainable from the use of that which I have just mentioned, with one additional, and to the patient most invaluable advantage, viz. that of never finding it necessary to have his leg or thigh once during the cure removed from the pillow on
which

which it has been properly deposited. In short, to quit reasoning and speak to fact, it is the constant practice at St. Bartholomew's, and attended with all possible success. We always use the eighteen-tailed bandage, and never move the limb to renew or adjust it *.

The parts of the general apparatus for a simple fracture, which come next in order, are the splints.

These are generally made of paste-board, wood, or some resisting kind of stuff, and are ordered to be applied lengthways on the broken limb; in some cases three, in others four; for the more steady and quiet detention of the fracture.

That splints properly made and judiciously applied are very serviceable, is beyond all doubt, but their utility depends much on their size and the manner in which they are applied.

In general practice, they are made of such length, as not to reach either upward or
downward,

* See the different opinions of different French practitioners, with their reasons on this subject, in Du Verney, *Traité des Maladies des Os*.

downward, so far as the roller extends; not to comprehend either the upper or the lower joint of the broken bone, and to exceed the fracture either way not many inches: they do not, for example, in the broken leg, comprehend either the joint of the knee, or the joint of the ankle, and act only on the fracture*.

In

* This is the old doctrine, and has been almost universally and constantly adhered to and followed. Our forefathers, finding that such splints as they used and applied in their manner excited pain and inflammation, did not use, but forbade them until after seven days were past, and the first inflammation, as they thought, was over.

After this, they put them on to strengthen the fracture, as they said, and therefore made them short for that purpose only, expressly cautioning us against the only method of applying them (in the case of a broken leg) in which they can be really useful, viz. that in which they comprehend both the knee and ankle.

“ Ferularum usus idem est ac pannorum ad fractum os
“ continendum, ut maneat immotum, etiamsi membrum
“ universum moveatur.

“ Jubet Hippocrates leves esse ferulas & æquales & ad
“ extrema refimas, &c.

“ Sed & breviores ferulas esse præcipit ipsa vinctura, ne
“ quando cutem proximam tentare valeant eminentem
“ plerumque ob humores receptos, quos fasciæ extur-
“ bant. Id quoque cavere oportet, ne ad ossium emi-
“ nentias, quales in ima tibia & sura sunt, ferulæ per-
“ tingant, &c. &c. &c.”

Oribasius de Fracturis.

“ Sed

In this manner of application and of this size, they are in fact neither more nor less than compresses, and compresses made of very bad materials. All the good that ever is, or that can be done by them, when of such length and so applied, might certainly be done in a better manner by a more proper kind of compress, and every disadvantage, which a hard resisting compress, injudiciously applied, is capable of producing, is probable to result from them thus used.

The true and proper use of splints is, to preserve steadiness in the whole limb, without compressing the fracture at all. By the former they become very assistant to the curative intention, by the latter they are very capable of causing pain and other inconveniences; at the same time that they cannot, in the nature of things, contribute to the steadiness of the limb.

In order to be of any real use at all, splints should, in the case of a broken leg, reach

“ Sed hoc tempore (post septimum diem) vice plagularum oportet ferulas apponere.

“ His utebatur Hippocrates demum post septimum diem; quia ante septimum magis urgebat intentio ar-
 “ cendæ inflammationis, quam intentio stabiliendi frac-
 “ turam; post septimum autem contra accidit.”

Fab, ab Aquapendente.

reach above the knee and below the ankle ; should be only two in number, and should be so guarded with tow, rag or cotton, that they should press only on the joints, and not at all on the fracture.

By this they become really serviceable ; but a short splint, which extends only a little above and a little below the fracture, and does not take in the two joints, is an absurdity ; and, what is worse, it is a mischievous absurdity.

By pressing on both joints, they keep not only them, but the foot steady ; by pressing on the fracture only, they cannot retain it in its place, if the foot be in the smallest degree displaced, but they may, and frequently do occasion mischief, by rudely pressing the parts covering the fracture against the edges and inequalities of it.

I suppose it will be said, that although short splints do not of themselves sustain and keep steady the two joints, and consequently the limb, yet that purpose in the broken leg may be and is fulfilled by junks, fannons and other contrivances : To which I answer, that then the short splints are in that case of no use at all, and had better be laid aside ; they should be used for no other
pur-

purpose, but that of keeping the limb steady ; and if they do not answer that end, they are an incumbrance, and multiply the articles in the apparatus for a fractured leg, very unnecessarily.

In the case of a fractured os femoris, if the limb be laid in an extended posture, one splint should certainly reach from the hip to the outer ankle, and another (somewhat shorter) should extend from the groin to the inner ankle. In the case of a broken tibia and fibula, there never can be occasion for more than two splints, one of which should extend from above the knee to below the ankle on one side, and the other splint should do the same on the other side. The manner of applying them, if the limb be deposited in a state of flexion, will come under the next article.

This, and indeed the most essential article in the treatment of a fracture is, the position of the limb. Upon the judicious or injudicious, the proper or improper execution of this, depends the ease of the patient during his confinement, and the free use and natural appearance of his limb afterward.

If

If I meant to describe, or if I approved (pardon the phrase) the common method of placing the broken leg and thigh in a straight manner, this would be the place to mention the many very ingenious contrivances and pieces of machinery, which practitioners, both ancient and modern, have invented for the purpose of keeping the whole limb straight and steady, that is, of keeping all the muscles surrounding the fractured bone constantly upon the stretch, and at the same time of preventing any inequality in the union of it, and any shortening of the limb, in consequence of such inequality.

But as it is my intention by these sheets, to inculcate another, and as it appears to me a better disposition of the limb, in which such boxes, cradles, and pieces of machinery are not wanted, nor can be used, it is needless for me to say any thing about them.

According to this plan, the fractured leg and thigh should be deposited on the pillow, in the very posture in which the extension was made, and the fracture set, that is with the knee bent.

I have

I have already been so explicit, or perhaps prolix, on the tense and lax state of the muscles, as depending on posture, under the head of extension, that I shall spare the reader, as well as myself, a good deal of trouble by referring back to that article. All that is there urged, or that can be urged for making the extension, that is, for setting a fracture in such disposition of a limb or its muscles, is equally powerful and conclusive with regard to the manner of depositing and leaving it after it has been set. Whatever render reduction and coaptation easy, must as necessarily maintain ease during the confinement, preserve rectitude of figure, and prevent displacement. The same principle must act on both occasions, and whether the doctrine be right or wrong, considered by itself, it must be equally so in both circumstances, that is, in the manner of setting a fracture, and in the manner of depositing the limb afterward *. In the
 case

* It has been said, that the straight position of a limb, by putting the muscles on the stretch, induces them to contribute to the security of the fracture against displacement. If this be the case in general, how happens it that those bones are always found most liable to be displaced when broken, and to be most difficult to keep in their proper place, which are surrounded by the most and by the strongest muscles?

case of the fractured os humeri, the only position in which it can with any tolerable convenience to the patient be placed is, with the elbow bent, that very position which necessarily relaxes and removes all the resistance of the surrounding muscles. Daily experience evinces the utility of this, by our very seldom meeting with lameness or deformity after it, notwithstanding the prevailing apprehension of exuberant callus.

The deformity frequently consequent to the fracture of the bones of the cubit, particularly that of the radius only, will generally, if not always, be found to be in proportion as the muscles concerned in the pronation and supination of the hand happen to be put more or less into a state of action, or tension by the position of the limb.

In the thigh, the case is still more obvious, as the muscles are more numerous and stronger.

The straight posture puts the majority of them into action, by which action that part of the broken bone, which is next to the knee, is pulled upward, and by passing more or less underneath that part
which

which is next to the hip, makes an inequality or rising in the broken part, and produces a shortness of the limb.

In the fracture of both bones of the leg, the case is still the same; a straight position puts the muscles upon endeavouring to act; a moderate flexion of the knee relaxes them, and takes off such propensity *.

The disposition therefore of the broken cubit ought to be that which, by putting the hand into a middle state between pronation and supination, and by bending the fingers moderately, keeps the radius superior to the ulna; or in other words, the palm of the hand should be applied to the breast, the thumb should be superior, the little finger inferior; and the hand should be kept in this posture constantly by means of two splints, which should reach from the joint of the elbow on each side, and should be extended below the fingers; or the same purpose may be still better answered by a simple neat contrivance of the very ingenious Mr. Gooch

* In proportion as the fracture shall happen to be more or less oblique, the truth of this doctrine will upon experiment be found to be more or less apparent, as well as useful.

Gooch of Norfolk; of which he has given a draught, and which is preferable to a common splint, by its admitting the fingers to be more easily bent.

The position of the fractured os femoris should be on its outside, resting on the great trochanter; the patient's whole body should be inclined to the same side; the knee should be in a middle state, between perfect flexion and extension, or half bent; the leg and foot lying on their outside also, should be well supported by smooth pillows, and should be rather higher in their level than the thigh; one very broad splint of deal, hollowed out and well covered with wool, * rag, or tow, should be placed under the thigh, from above the trochanter quite below the knee, and another somewhat shorter should extend from the groin below the knee on the inside, or rather in this posture on the upper side; the bandage should be of the eighteen-tail kind, and when the bone has been set, and the thigh well placed on the pillow, it should not, without

* If the pillow on which the broken thigh is placed be not too thick, the splint may with equal advantage be placed underneath such pillow, and in many cases this will be found to be the best manner of using it.

without necessity, (which necessity in this method will seldom occur) be ever moved from it again until the fracture is united; and this union will always be accomplished in more or less time, in proportion as the limb shall have been more or less disturbed.

In the fracture of the fibula only, the position is not of much consequence, because by the tibia remaining intire, the figure of the leg is preserved and extension quite unnecessary; but still even here the laying the leg on its side, instead of on the calf, is attended with one very good consequence, viz. that the confinement of the knee, in a moderately bent position, does not render it so incapable of flexion and use afterward, as the straight or extended position of it does, and consequently that the patient will be much sooner able to walk, whose leg has been kept in the former posture, than he whose leg has been confined in the latter.

In the fracture of both tibia and fibula, the knee should be moderately bent, the thigh, body and leg in the same position as in the broken thigh. If common splints be used, one should be placed underneath the

E

leg.

leg, extending from above the knee to below the ankle, the foot being properly supported by pillows, bolsters, &c. and another splint of the same length should be placed on the upper side, comprehending both joints in the same manner ; which disposition of splints ought always to be observed, as to their length, if the leg be laid extended in the common way, only changing the nominal position of them, as the posture of the leg is changed, and calling what is inferior in one case, exterior in the other, and what is superior in one, in the other interior*.

If Mr. Sharpe's splints be made use of, there is in one of them a provision for the more easy support of the foot and ankle, by an excavation in, and a prolongation of the
lower

* All writers on this subject agree in giving us cautions about defending the heel, and filling up the hollow from it to the calf of the leg ; and this they do on account of the pain, excoriation, and even ulceration, which sometimes attends the straight position, with the limb resting on the heel.

Many of them have also taken notice of an accident sometimes attendant on a broken leg, but which really ought to be set to the account of the posture in which such leg is placed, more than to that of the fracture ; I mean the shrinking or wasting of the calf.

lower or fibular splint, for the purpose of keeping the foot steady.

I hope that I have expressed my meaning clearly; I should be very sorry to be mistaken, because it appears to me to be a matter of some consequence; and if what I have said be intelligible, the reader will understand from thence, that I mean to signify that, (in my opinion,) extension will in general be made with more facility, and coaptation more happily executed, that a patient will suffer a great deal less pain during these operations, as well as during the necessary confinement for a broken leg or thigh, and that both patient and surgeon will be less likely to be disappointed in their intention and wish, that is, that the former will be less liable to lameness or deformity, when a fractured thigh or leg has been treated in the way I have described than in the common one.

The resistance necessarily made by the muscles, joined to the great instability of parts in every species of fractured leg or thigh, except in the few where the bones

are broken transversely, has constantly exercised the invention and ingenuity of practitioners, in devising means to prevent inequality in the callus as it is called, and shortness and deformity in the limb. Our books abound with draughts and descriptions of machines for this purpose; ligatures, pulleys, leaden weights and fracture-boxes, so constructed, as to overcome and constantly to resist that action of the muscles surrounding the broken bone, that natural tendency in them to contract, which the extended position of the limb necessarily induces. Every body who has been conversant with matters of this sort knows, that even the best of these various contrivances often prove successful, and every one who will reflect ever so little may see why they must be so. That they do prove ineffectual, the number of deformed legs and shortened thighs, which are daily met with, evinces; and that they must frequently prove so will be obvious to every one, who will consider that the effect can last no longer than the cause is continued, unless there happens to be some very favourable circum-

circumstance in the fracture itself. What I mean is this, when the reduction of the fracture is set about, the limb is put into such position, that the surrounding muscles resist the extending force very considerably, and this in proportion to their strength and number: that force is continued and increased till the muscles give way, and the resistance being overcome, an opportunity is thereby obtained of placing the ends of the fracture in as apt position with regard to each other, as the nature of it will admit. If the fracture be of the transverse kind, that is, if the ends of the broken bone be large and afford a good deal of space for contact with each other, such apposition will contribute a good deal to the keeping the limb steady and the fracture even; but if the fracture be of the oblique kind, if there be several loose pieces, and consequently neither large contact nor stability from the apposition, or if due extension has not been made or could not, or if the ends of the bones have not been judiciously and properly set, the muscles will act as soon as the extension is relaxed, the fracture will be more or less displaced, according to the nature of it, the limb will be shortened, the

time of union will be prolonged, and the place of it (the callus, as it is called) will be in proportion more or less unequal.

I take it for granted that it will be asked, Have not our ancestors in all times happily redressed fractured legs and thighs, by the method which they have delivered down to us, and which in the preceding pages I have taken the liberty to object to? have not such limbs frequently been rendered as straight, as useful, and as little deformed as possible? I answer, most certainly, yes; it is an undoubted truth and cannot be denied. But in my turn, let me be permitted to ask, Whether in the same method great and even unfurmoutable difficulty is not frequently met with? whether in many cases the act of setting, as it is called, is not excessively painful at the time, and productive of inflammation and other disagreeable symptoms afterward? and whether in spite of all care, of every contrivance, of every species of machinery which has yet been used, broken thighs and legs are not often, very often left deformed, crooked and shortened, and that merely from the action of the muscles and the obliquity or shattered state of the fracture? The fact is notorious, and the
sole

sole question is, Whether or no a different disposition of the parts, preventing such action and such resistance, will in many instances prevent these evils? to which, from repeated experience, I answer, yes. If this should be found to be the case in general, of which I make no doubt; that is, if by this method, many of such unfortunate cases, as in the common method of treatment disappoint both patient and surgeon, should be found in general to succeed so well as to satisfy both, it will prove all I wish it should prove. Superior utility and more frequent success are all I contend for.

Many people did very well under amputation before the double incision was practised; but is the double incision therefore no improvement? The operation for the bubonocoele may be performed with that clumsy instrument the probe scissars, but is the bistoury therefore not preferable? A surgeon may cut off some ounces, or even pounds of flesh from a patient's backside, in order to cure a sinus, but is the cure by the simple division of that sinus therefore not easier or more expeditious? Neither of these can (I think) be proved, unless it can at the same time be proved, that pain is no

evil, confinement not at all irksome, and that deformity and elegance of figure are synonymous terms.

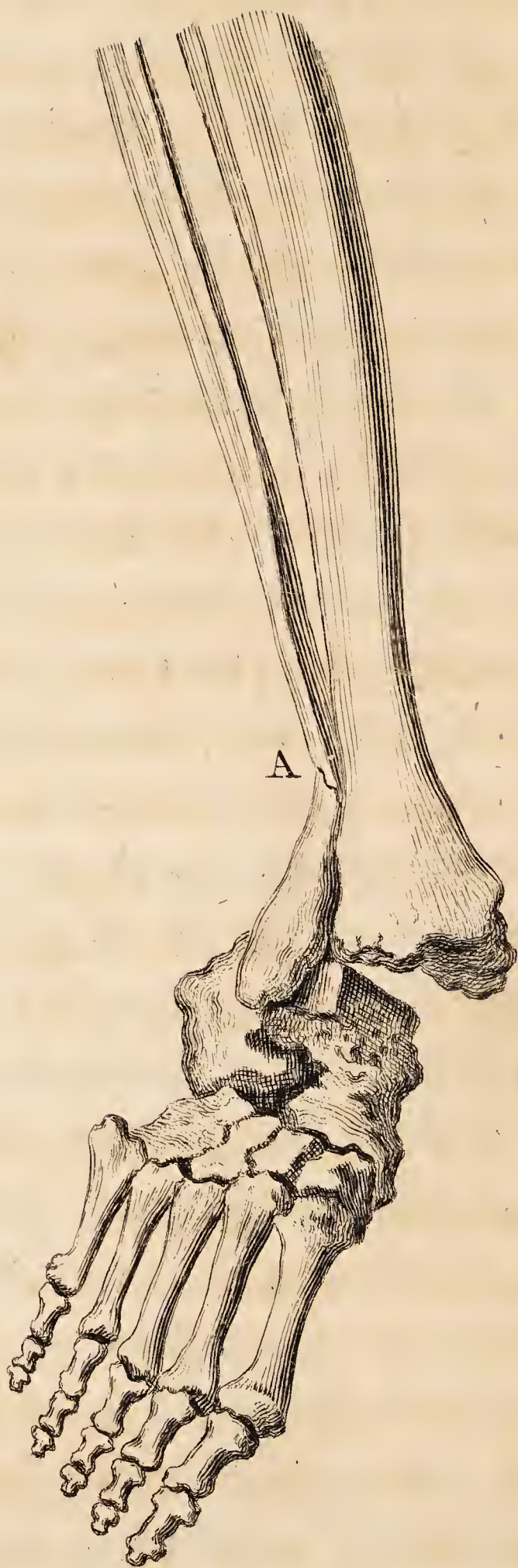
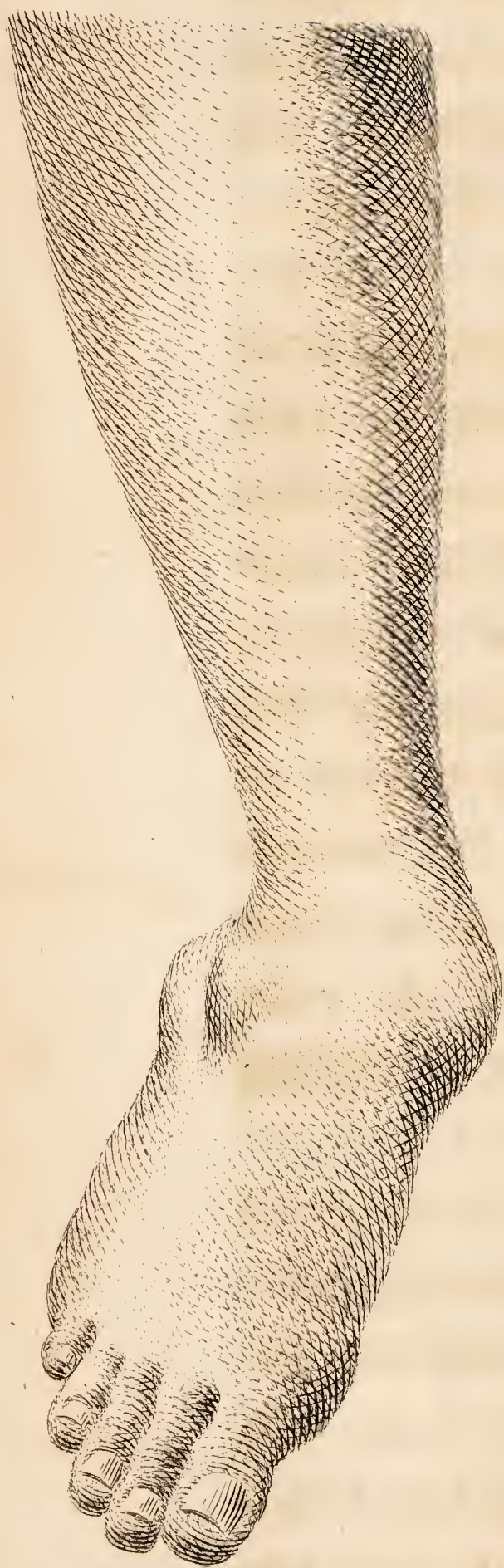
Let not the reader fancy that I would dare to amuse him with speculation, or merely specious reasoning on a subject like this. What I have said is from experience, repeated experience both of myself and of others, for a considerable length of time past, and on a great variety of subjects; from an experience which has perfectly satisfied me, and I think will every man who will make the trial fairly and candidly. — I do not pretend to say, that by these means every kind of broken bone will infallibly and certainly be brought to lie smooth, even, and of proper length; if I did, they who are versed in these things, would know that I said too much; but I will say, (what is sufficient for my purpose) that it will not only succeed in all those, in which the old method can ever be successful, but also in the majority of those in which it is not nor in the nature of things can. In those fortunate cases, in which either method will do, the old one is fatiguing, inconvenient, and even sometimes offensive, from the supine
and

and confined posture of the patient ; whereas that which is here proposed gives the patient much greater liberty of motion for every purpose either of choice or necessity, and in many of those cases, wherein the old method proves most frequently so far unsuccessful, as to leave the limb short, lame, or deformed ; I say, in most of these the proposed method will not be attended with these inconveniences.

I have already said, that in most cases of broken thigh or leg, the method just described will be attended with great success : but there is one particular case in which its utility is still more conspicuous ; a case which, according to the general manner of treating it, gives infinite pain and trouble both to the patient and surgeon, and very frequently ends in the lameness and disappointment of the former, and the disgrace and concern of the latter : I mean the fracture of the fibula attended with a dislocation of the tibia.

Whoever will take a view of the leg of a skeleton, will see that although the fibula be a very small and slender bone, and very inconsiderable in strength, when compared with the tibia, yet the support of the lower joint

joint of that limb, (the ancle) depends so much on this slender bone, that without it the body would not be upheld, nor locomotion performed, without hazard of dislocation every moment. The lower extremity of this bone, which descends considerably below that end of the tibia, is by strong and inelastic ligaments firmly connected with the last-named bone, and with the astragalus, or that bone of the tarsus which is principally concerned in forming the joint of the ancle. This lower extremity of the fibula has, in its posterior part, a superficial sulcus for the lodgment and passage of the tendons of the peronei muscles, which are here tied down by strong ligamentous capsulæ, and have their action so determined from this point or angle, that the smallest degree of variation from it, in consequence of external force, must necessarily have considerable effect on the motions they are designed to execute, and consequently distort the foot. Let it also be considered, that upon the due and natural state of the joint of the ancle, that is, upon the exact and proper disposition of the tibia and fibula, both with regard to each other and to the astragalus, depend the just disposition and proper action of



of several other muscles of the foot and toes; such as the gastrocnemii, the tibialis anticus, and posticus, the flexor pollicis longus, and the flexor digitorum pedis longus, as must appear demonstrably to any man who will first dissect and then attentively consider these parts.

If the tibia and fibula be both broken, they are both generally displaced in such manner, that the inferior extremity, or that connected with the foot, is drawn under that part of the fractured bone which is connected with the knee; making by this means a deformed, unequal tumefaction in the fractured part, and rendering the broken limb shorter than it ought to be, or than its fellow. And this is generally the case, let the fracture be in what part of the leg it may.

If the tibia only be broken, and no act of violence, indiscretion, or inadvertence be committed, either on the part of the patient or of those who conduct him, the limb most commonly preserves its figure and length; the same thing generally happens if the fibula only be broken, in all that part of it, which is superior to letter *A* in the annexed figure, or in any part of it between

tween its upper extremity, and within two or three inches of its lower one.

I have already said, and it will obviously appear to every one who examines it, that the support of the body and the due and proper use and execution of the office of the joint of the ankle depend almost entirely on the perpendicular bearing of the tibia upon the astragalus, and on its firm connection with the fibula. If either of these be perverted or prevented, so that the former bone is forced from its just and perpendicular position on the astragalus, or if it be separated by violence from its connection with the latter, the joint of the ankle will suffer a partial dislocation internally * ; which partial dislocation cannot happen without not only a considerable extension, or perhaps laceration of the tarsal ligament of the joint, which is lax and weak, but a laceration of those strong tendinous ligaments, which connect the lower end of the tibia with the astragalus and os calcis, and which constitute in great measure the ligamentous strength of the joint of the ankle.

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* See the figure at the preceding page.

This is the case, when by leaping or jumping the fibula breaks in the weak part already mentioned, that is within two or three inches of its lower extremity. When this happens, the inferior fractured end of the fibula falls inward toward the tibia, that extremity of the bone which forms the outer ancle is turned somewhat outward and upward, and the tibia having lost its proper support, and not being of itself capable of steadily preserving its true perpendicular bearing, is forced off from the astragalus inwards, by which means the weak burfal, or common ligament of the joint is violently stretched, if not torn, and the strong ones, which fasten the tibia to the astragalus and os calcis, are always lacerated, thus producing at the same time a perfect fracture and a partial dislocation, to which is sometimes added a wound in the integuments, made by the bone at the inner ancle. By this means, and indeed as a necessary consequence, all the tendons which pass behind or under, or are attached to the extremities—of the tibia and fibula, or os calcis, have their natural direction and disposition so altered, that instead of performing their appointed actions, they all contribute

bute to the distortion of the foot, and that by turning it outward and upward.

When this accident is accompanied, as it sometimes is, with a wound of the integuments of the inner ankle, and that made by the protrusion of the bone, it not infrequently ends in a fatal gangrene, unless prevented by timely amputation, though I have several times seen it do very well without. But in its most simple state, unaccompanied with any wound, it is extremely troublesome to put to rights, still more so to keep it in order, and unless managed with address and skill, is very frequently productive both of lameness and deformity ever after.

After what has been said, a farther explanation why this is so is unnecessary. Whoever will take even a cursory view of the disposition of the parts, will see that it must be so. By the fracture of the fibula, the dilatation of the burfal ligament of the joint, and the rupture of those which should tie the end of the tibia firmly to the astragalus and os calcis, the perpendicular bearing of the tibia on the astragalus is lost, and the foot becomes distorted; by this distortion the direction and action of all the muscles already recited are so altered, that it becomes

becomes (in the usual way of treating this case) a difficult matter to reduce the joint, and, the support of the fibula being gone, a more difficult one to keep it in its place after reduction. If it be attempted with compress and strict bandage, the consequence often is a very troublesome as well as painful ulceration of the inner ankle, which very ulceration becomes itself a reason why such kind of pressure and bandage can be no longer continued; and if the bone be not kept in its place, the lameness and deformity are such, as to be very fatiguing to the patient, and to oblige him to wear a shoe with an iron, or a laced buskin, or something of that sort, for a great while, or perhaps for life.

All this trouble, pain, difficulty, and inconvenience, are occasioned by putting and keeping the limb in such position, as necessarily puts the muscles into action, or into a state of resistance, which in this case is the same. This occasions the difficulty in reduction, and the difficulty in keeping it reduced; this distorts the foot, and by pulling it outward and upward makes that deformity, which always accompanies such accident; but if the position of the limb
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be changed, if by laying it on its outside with the knee moderately bent, the muscles forming the calf of the leg, and those which pass behind the fibula and under the os calcis, are all put into a state of relaxation and non-resistance, all this difficulty and trouble do in general vanish immediately; the foot may easily be placed right, the joint reduced, and by maintaining the same disposition of the limb, every thing will in general succeed very happily, as I have many times experienced.

Two kinds of fracture there are, and only two that I can recollect (relative to the limbs) which do not admit of the bent position of the joints, I mean that of the processus olecranon at the elbow, and that of the patella; in these a straight position of the arm and leg is necessary, in the former to keep the fractured parts in contact till they are united, in the latter, to bring them as near to each other as may best serve the purpose of walking afterward*.

With

* Although a straight position of the limb is necessary for the broken patella, yet this very position becomes so upon the same principle, as renders the bent posture most advantageous in the broken tibia and femur, viz. the relaxation

With regard to the fracture of the patella, an opinion has long and generally prevailed, which seems to me to have no foundation in truth, or (when duly considered) even in probability; it is, that the great degree of stiffness in the joint of the knee, which is sometimes found to be the consequence of this kind of fracture, is owing to,

laxation of the muscles and tendons attached to the fractured bone.

Whoever will for moment attend to the disposition of the pieces in a patella, which has been broken transversely, will see how little necessary or useful the many contrivances of bandages, straps, compresses, buckles, buttons, &c. to be found in writers are, especially all that part of them which are applied to the inferior fragment.

By the action of the united tendons of the extensores muscles of the leg, the superior fragment is pulled upward and separated from the inferior, but the latter remains nearly, if not absolutely, where it was before the accident; there is nothing to act upon it, and therefore it cannot, nor does it move.

The extension of the leg puts the muscles attached to the upper part of the broken bone into a state of relaxation, and prevents their acting; and though a small compress just above this piece, with a moderate bandage, may be useful toward retaining it, yet it is the position of the leg which must keep the broken piece down, and effect the cure.

to, or produced by, a quantity of callus falling into it from the edges of the broken bone, and that the nearer the broken pieces are brought to each other, the more likely such consequence is.

Every part of this doctrine seems equally absurd. In the first place, the fractured bone is by no means capable of supplying such a quantity of callus as to produce this end, unless it may be supposed to run from it as solder from a plumber's ladle; in the second place, if this was the case, the most likely, and indeed the only probable way of preventing the deposition of such juice, must be by bringing the broken pieces into close contact; and in the third place, there is no authority from the appearance of such joints after death, (at least as far as my experience goes) to suppose this to be the case, or to countenance such opinion. The cause therefore of this rigidity, which is now and then found to attend the broken patella, must be sought for elsewhere, viz. in the long rest and confinement of the joint, as a means used by many to procure exact union; in mischief done to the ligament, which is formed by the united tendons of the four extensor

tensor muscles of the leg, at the time of and by the fracture ; and in the nature of the fracture itself, that is, the manner in which the bone shall happen to be broken.

But, be all this as it may, the fact undoubtedly is, that they walk best after such accident, whose patella has been broken transversely, and that into two nearly equal fragments ; whose confinement to the bed has been short, that is, no longer than while the inflammation lasted ; whose knee, after such period, has been daily and moderately moved ; and in whom the broken pieces are not brought into exact contact, but lie at some small distance from each other.

I cannot take leave of this subject of simple fractures, without mentioning a circumstance relative to them, which although, when rightly understood, is of little or no importance, yet by being misunderstood, becomes frequently of considerable consequence.

I mean, the use of the term, *rising end of a broken bone*.

By the expression, any one unacquainted with these things would be inclined to

think, that the prominent part of a broken bone rose, or was elevated from its natural place, and became by such rising superior to the other part or extremity of the fracture. This would certainly be the idea of an ignorant person, and as such would be of little consequence; but by the practice of many, who call themselves surgeons, it is as certainly their idea also, and this renders it a matter of great consequence. Many instances are producible, in which our conduct is in great measure regulated by the language which we use. Having no ideas annexed to our words leads us into absurdity and unintelligibility, but false ones influence us still more, and frequently produce very material errors.

The fistula lachrymalis, the fistula in perinæo, and that in ano, are glaring proofs of this, and my present subject is full as much so: for upon the erroneous idea annexed to the term *rising end*, stands all the absurd practice of compress, bolster, and strict bandage in the cases of simple fracture *.

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* I was some few years ago carried by a surgeon, since dead,

The truth is, that there is really no *rising end* to a broken bone ; I mean, when applied, as the term usually is, to the leg, thigh and clavicle. There is indeed a superior or prominent end or part, and an inferior or depressed one, but the former of these is in its proper place, from which it cannot by art be moved, and the latter, which is not in its proper place, is very capable by art of being put into it.

Perhaps this may to some appear a mere play of words, a nominal distinction without a real difference ; but when the influence, which a right or wrong idea of this produces on practice is attended to, the consequence will be obvious and serious.

When a collar bone, os femoris, or tibia and fibula are broken, by the action of the muscles, by the motions of the patient, and by the mere weight of the inferior part of the arm, thigh or leg, the fractured ends of such
bones

dead, to see a contrivance of his own to keep down the rising end of a broken tibia. It was somewhat upon the principle of Petit's tourniquet, and calculated to act by compression. I told him my opinion freely, but the inventor was wedded to his invention, and the first simple fracture he applied it to, he thereby converted into a compound one, by pressing the bone through the skin.

Bones are displaced, and always displaced in such manner, that the inequality occasioned necessarily by such displacement, proceeds from the inferior end of the fractured bone being retracted or drawn under the superior : this produces a tumefaction or unequal rising, and the upper extremity of the fracture is therefore called the rising end of it. Now the man who regards this rising end, as that part of the fracture which has by such rising got out of its place, and not as having accidentally become the prominent part merely by the infinuation or retraction of the other part underneath it, will go to work with bolster, compress and bandage, in order to bring and keep such end down ; by which means he will give his patient considerable pain, and while he depends on such means alone, will most certainly be frustrated in his intention and expectation, the means not being adequate to the proposed end. But the man who looks on this in the true light, that is, who looks on the superior part, as being in its proper place, and the inferior, as being displaced by the weight of the limb, and the action of the muscles, will know, that by the mere position
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of such limb, he shall be able to remedy all the inconvenience and deformity, as far as they are by art capable of remedy, without the parade, or the fatigue of useless apparatus.

He will, for example, know that the prominent part of a broken clavicle, that part of it which is next to the sternum, is just where it should be, and that the inferior part, that which is connected with the scapula, is out of its place, by being drawn down by the weight of the arm; and therefore instead of loading, as is usual, the prominent part with quantities of compress, which never can do any service, he, by a proper elevation of the arm, will bring the lower end upward into contact with the other, and thereby with very little trouble easily accomplish what he never can do in any other manner, however operose.

The same thing will happen from the same principles in the leg and thigh; a prominence, or a rising end, there always will be, but that rising end is never to be brought down by any pressure from compress or bandage; the fallen or inferior one must always be brought up to it, by the proper position of the rest of the limb:

this will always remove the inequality as far as it is removeable, and nothing else can*.

* In a profest regular treatise on this subject, it would be right to take notice of what may be called the infortunia or accidental evils, which sometimes accompany even simple fractures; such are, disease arising from injury done to the medullary membrane, within the bones, in bad habits: hæmorrhage, or a species of spurious aneurism, from a wound of the interosseal artery, between the tibia and fibula, or of either of the carpal arteries: mischief from the fracture becoming accidentally the seat of the crisis of a fever, deficiency of callus, or the accident of the broken bone not uniting: the fractured limb becoming the seat of an erysipelas, terminating in a slough of the common membrane and periosteum: the gelatinous juice or callus, which should unite the fracture, being in so morbid a state, as to produce a kind of caries with exostosis, instead of its doing its proper duty, &c. Of all these there are examples, but they do not come within the plan which I prescribed to myself when I began these papers.

C O M-

COMPOUND FRACTURES.

I Use the term compound fracture in the sense in which the English have always used it, that is, to imply a broken bone complicated with a wound.

In this kind of case the first object of consideration is, whether the preservation of the fractured limb can, with safety to the patient's life, be attempted; or, in other words, whether the probable chance of destruction, from the nature and circumstances of the accident, is not greater than it would be from the operation of amputation. Many things may concur to make this the case. The bone or bones being broken into many different pieces, and that for a considerable extent, as happens from broad wheels, or other heavy bodies of large surface, passing over, or falling on such limbs; the skin, muscles, tendons, &c. being so torn, lacerated and destroyed, as to render
gangrene

gangrene and mortification the most probable and most immediate consequence; the extremities of the bones forming a joint being crushed, or as it were comminuted, and the ligaments connecting such bones being torn and spoiled are, among others, sufficient reasons for proposing and for performing immediate amputation. Reasons, which (notwithstanding any thing that may have been said to the contrary) long and reiterated experience has approved, and which are vindicable upon every principle of humanity, or chirurgic knowledge.

When a surgeon says, that a limb, which has just suffered a particular kind of compound fracture, ought rather to be immediately cut off, than that any attempt should be made for its preservation, he does not mean by so saying, that it is absolutely impossible for such limb to be preserved at all events; he is not to be supposed to mean so much in general, though sometimes even that will be obvious; all that he can truly and justly mean is, that from the experience of all time it has been found, that the attempts to preserve limbs so circumstanced, have most frequently been frustrated by the death of the patients, in consequence of
such

such injury ; and that from the same experience it has been found, that the chance of death from amputation is by no means equal to that arising from such kind of fracture.

Every man knows, that apparently desperate cases are sometimes cured ; and that limbs so shattered and wounded, as to render amputation the only *probable* means for the preservation of life, are now and then saved. This is an uncontroverted fact, but a fact which proves very little against the common opinion ; because every man of experience also knows, that such escapes are very rare, much too rare to admit of being made precedents, and that the majority of such attempts fail *.

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* The baron Van Swieten, writing as many others have done, that is, theoretically on surgery, advises us, in the case of very bad compound fractures, which may most probably require amputation, to defer the operation, until we have tried the force of antiseptic fomentations and applications of like kind for two or three days ; and this opinion and advice he builds, in some measure, on a remarkable success of La Motte, in a seemingly desperate case, of a man's leg mashed by the wheel of a heavy carriage.

That De La Motte's patient escaped, I make no doubt, because he has said so ; but the surgeon shewed much more rashness in attempting to save such a limb, than he would have done in the amputation of it ; the operation
would

This consideration relative to amputation is of the more importance, because it most frequently requires immediate determination ; every minute of delay is in many instances to the patient's disadvantage, and a very short space of time indeed, frequently makes all the difference between probable safety and fatality. If these cases in general would admit of deliberation for two or three days, and during that time such circumstances might be expected to arise, as ought necessarily to determine the surgeon in his conduct, without adding to the patient's hazard, the difference would be considerable ; the former would not seem to be so precipitate in his determination, as he is frequently thought to be, and the latter being more convinced of the necessity, would

would have been the more justifiable practice.—With regard to the baron's advice, to stay two or three days, I take the liberty to add, that if you do that, stay several more ; for at the end of that time (I mean two or three days) the patient will have very little chance indeed from the operation, much less than he would have had at the time of the accident.

I should be very sorry to be thought a patron or an adviser of rashness or cruelty ; but in what I have here said, I believe I shall have every man in the profession, who has either true humanity or sound judgment founded on experience, on my side.

would submit to it with less reluctance. But unhappily for both parties, this is seldom the case; and the first opportunity having been neglected or not embraced, we are very frequently denied another. Here therefore the whole exertion of a man's judgment is required, that he may neither rashly and unnecessarily deprive his patient of a limb, nor through a false tenderness or timidity, suffer him to perish, by endeavouring to preserve such limb. Some degree of address is also necessary upon such occasion, in order to convince the patient, that what seems to be determined upon hastily and with precipitation, will not safely admit of longer deliberation.

The limb being thought capable of preservation, the next consideration is the reduction of the fracture. The ease or difficulty attending this depends, not only on the general nature of the case, but on the particular disposition of the bone with regard to the wound.

If the bone be not protruded forth, the trouble of reducing, and of placing the fracture in a good position, will be much less, than if the case be otherwise; and in the case of protrusion or thrusting forth of
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the bone or bones, the difficulty is always in proportion to the comparative size of the wound, through which such bone has passed. In a compound fracture of the leg or thigh, it is always the upper part of the broken bone which is thrust forth. If the fracture be of the transverse kind, and the wound large, a moderate degree of extension will in general easily reduce it; but if the fracture be oblique, and terminates, as it often does, in a long sharp point, this point very often makes its way through a wound no larger than just to permit such extension. In this case, the very placing the leg in a straight position, in order to make extension, obliges the wound or orifice to gird the bone tight, and makes all that part of it, which is out of such wound, press hard on the skin of the leg underneath it. In these circumstances, all attempts for reduction in this manner will be found to be impracticable; the more the leg is stretched out, the tighter the bone will be begirt by the wound, and the more it will press on the skin underneath.

Upon this occasion, it is not very unusual to have recourse to the saw, and by
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that means to remove a portion of the protruded bone.

I will not say that this is always or absolutely unnecessary or wrong, but it most certainly is frequently so. In some few instances, and in the case of extreme sharp-pointedness of the extremity of the bone, it may be, and undoubtedly is right: but in many instances it is totally unnecessary.

The two most proper means of overcoming this difficulty are, change of posture of the limb, and enlargement of the wound. In many cases the former of these under proper conduct will be found fully sufficient, and where it fails, the latter should always be made use of. Whoever will attend to the effect, which putting the leg or thigh (having a compound fracture and protruded bone) into a straight position always produces; that is, to the manner in which the wound in such position girds the bone, and to the increased difficulty of reduction thereby induced, and will then, by changing the posture of such limb from an extended one, to one moderately bent, observe the alteration thereby made, in both the just-mentioned circumstances, will be satisfied of the truth of what I have said,
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and of the much greater degree of ease and practicability of reduction in the bent, than in the extended position, that is, in the relaxed, than in the stretched state of the muscles. Reduction being found impracticable, either by extension or change of posture, the obvious and necessary remedy for this difficulty is enlargement of the wound. This to some practitioners, who have not seen much of this business, appears a disagreeable circumstance, and therefore they endeavour to avoid it; but their apprehensions are in general groundless and ill-founded; in enlarging the wound there is neither difficulty nor danger, it is the skin only which can require division, and in making such wound there can be no possible hazard. It is needless to say that the division should be such as to render reduction easy; or to remind the practitioner, that such enlarged opening may serve very good future purposes, by making way for the extraction of fragments, and the discharge of matter, sloughs, &c.

If the bone be broken into several pieces, and any of them be either totally separated, so as to lie loose in the wound, or if they be so loosened and detached as to render

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der their union highly improbable, all such pieces ought to be taken away; but they should be removed with all possible gentleness, without pain, violence or laceration, without the risque of hæmorrhage, and with as little poking into the wound as possible. If the extremities of the bone be broken into sharp points, which points wound and irritate the surrounding parts, they must be removed also. But the whole of this part of the treatment of a compound fracture should be executed with great caution; and the practitioner should remember, that if the parts surrounding the fracture be violated, that is, be torn, irritated, and so disturbed as to excite great pain, high inflammation, &c. it is exactly the same thing to the patient and to the event of the case, whether such violence be the necessary consequence of the fracture, or of his unnecessary, and awkward manner of poking into and disturbing the wound. The great objects of fear and apprehension in a compound fracture (that is, in the first or early state of it) are, pain, irritation and inflammation; these are to be avoided, prevented, and appeased by all possible means, let every thing else be as it may; and al-

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though certain things are always recited, as necessary to be done, such as removal of fragments of bone, of foreign bodies, &c. &c. yet it is always to be understood, that such acts may be performed without prejudicial or great violence, and without adding at all to the risque or hazard necessarily incurred by the disease.

Reduction of or setting a compound fracture is the same as in the simple, that is, the intention in both is the same, viz. by means of a proper degree of extension to obtain as apt a position of the ends of the fracture with regard to each other, as the nature of the case will admit, and thereby to produce as perfect and as speedy union as possible.

To repeat in this place what has already been said under the head of extension would be tedious and unnecessary. If the arguments there used for making extension, with the limb so moderately bent as to relax the muscles, and take off their power of resistance, have any force at all, they must have much more, when applied to the present case: if it be allowed to be found very painful to extend, or to put or keep on the stretch, muscles which are not at all or but slightly

slightly wounded, and only liable in such extension to be pricked and irritated, it is self-evident that it must be much more so when the same parts are torn and wounded considerably ; when the ends of the fractured bone have made their way quite through them, divided the skin, and laid all open to the access of the air.

Every consequence which does or may be supposed to flow from wound, pain or irritation, in consequence of violence, must necessarily be much greater, when a lacerated wound, and that made by the bone, is added to the fracture ; not to mention the ills arising from extending or stretching out muscles already torn or half divided.

One moment's reflection must be sufficient to convince any reasonable man : but experience is the only proper test of all these kinds of things. Let this method of treatment then, be fairly and properly subjected to it ; and if the great advantage of the one over the other does not appear, that is, if the less sensation of pain by the patient, and the more happy, more perfect, and more expeditious accomplishment of his purpose by the surgeon, do not determine greatly in favour of relaxed position,

I am, and have for a considerable length of time been, greatly mistaken.

The wound dilated, (if necessary) loose pieces removed, (if there were any) and the fracture reduced, and placed in the best possible position, the next thing to be done is to apply a dressing.

On this subject a great deal has been said by writers, particularly by such of them as have implicit faith in external applications; but, in order to be able to execute this part of the process properly, a man has only to ask himself, What are the intentions which, by any kind of dressing to a compound fracture, he means to aim at the accomplishment of? And a rational answer to this will give him all that he can want to know.

The dressing necessary in a compound fracture is of two kinds, viz. that for the wound, and that for the limb. By the former, we mean to maintain a proper opening for the easy and free discharge of gleet, sloughs, matter, extraneous bodies, or fragments of bone, and this in such manner, and by such means, as shall give the least possible pain or fatigue, shall neither irritate by its qualities, nor oppress by its quantity, nor by any means contribute to the deten-

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tion or lodgment of what ought to be discharged. By the latter, our aim should be the prevention or removal of inflammation, in order, if the habit be good, and all other circumstances fortunate, that the wound may be healed, by what the surgeons call the first intention, that is, without suppuration or abscess; or that not being practicable, that gangrene and mortification, or even very large suppuration may be prevented, and such a moderate and kindly degree of it established, as may best serve the purpose of a cure. The first therefore, or the dressing for the wound, can consist of nothing better or indeed so good, as soft dry lint, laid on so lightly as just to absorb the sanies, but neither to distend the wound, or be the smallest impediment or obstruction to the discharge of matter. This lint should be kept clear of the edges, and the whole of it should be covered with a pledgit spread with a soft easy digestive. The times of dressing must be determined by the nature of the case; if the discharge be small or moderate, once in twenty-four hours will be sufficient; but if it be large, more frequent dressing will be necessary, as well to prevent offence, as to remedy the

inconveniences arising from a great discharge of an irritating sharp sanies.

The method of treating the limb, with a view to the prevention of such accidents and symptoms, as pain, inflammation, and laceration of parts are likely to produce, is different with different practitioners ; some using from the very first, relaxing, greasy applications, others applying medicines of very different nature. Both these may be right conditionally, that is, according to different circumstances in the case, but they cannot be equally so in the same circumstances.

Many practitioners are accustomed to envelope compound fractures in a soft, warm relaxing cataplasm from the very first ; whether the limb be in a tense swollen state or not. This, if I may take the liberty of saying so, appears to me to be injudicious. When from neglect, from length of time passed without assistance, from misconduct or drunkenness in the patient, from awkwardness and unhandiness in the assistants, or from any other cause a tension has taken possession of the limb, and it is become tumid, swollen and painful, a warm cataplasm is certainly the best and most proper application

tion that can be made, and that for very obvious reasons; the state of the parts under these circumstances is such, that immediate union is impossible, and nothing but a free and plentiful suppuration can dissipate or remove impending mischief: every thing therefore which can tend toward relaxing the tense, swollen, and irritable state of the parts concerned, must necessarily be right; the one thing aimed at, (plentiful suppuration) cannot be accomplished without it. But when the parts are not in this state, the intention seems to be very different. To relax swollen parts, and to appease pain and irritation by such relaxation, is one thing; to prevent inflammatory defluxion and tumefaction is certainly another; and they ought to be aimed at by very different means. In the former, a large suppuration is a necessary circumstance of relief, and the great means of cure; in the latter it is not, and a very moderate degree of it is all that is required. The warm cataplasm therefore, although it be the best application that can be made use of in the one case, is certainly not so proper in the other, as applications of a more discutient kind, such as mixtures of spirit. vini, vine-

gar and water, with crude sal ammoniac, spirit. Mindereri, acet. litharg. and medicines of this class, in whatever form the surgeon may chuse. By these, in good habits, in fortunately-circumstanced cases, and with the assistance of what should never be neglected, I mean phlebotomy, and the general antiphlogistic regimen, inflammation may sometimes be kept off, and a cure accomplished, without large collections or discharges of matter, or that considerable degree of suppuration, which though necessary in some cases, and almost unavoidable in others, are and must be rather promoted and encouraged than retarded or prevented, by warm relaxing applications of the pultice kind.

Compound fractures in general require to be dressed every day, and the wounded parts not admitting the smallest degree of motion without great pain, perfect quietude becomes as necessary as frequent dressing.

The common bandage therefore (the roller) has always in this case been laid aside, and what is called the eighteen-tailed bandage substituted, very judiciously, in its place. Of this I have already spoken so largely, as to make repetition unnecessary.

Splints,

Splints, that is, such short ones as are most commonly made use of in simple fractures, are by all forbid in the compound, and that for the same reason which ought to have prevented them from having ever been used in the former, viz. because the probable good to be derived from them can be but little, and the probable mischief is obvious and considerable.

But although short splints are for many reasons palpably improper in both cases, yet those of proper length, those which reach from joint to joint, comprehend them both, and, applied on each side of the leg only, are very useful both in the simple and in the compound fracture, as they may, thus applied, be made to keep the limb, more constantly steady and quiet, than it can be kept without them.

With regard to position of the limb, I have already been so explicit, when speaking of the simple fracture, that to say any thing more about it here would be an abuse of the reader's time and patience. The only, or the material difference between a simple and a compound fracture, as far as relates to this part of the treatment, is, that as the parts surrounding the broken bone

bone in the latter are more injured, and consequently more liable to irritation, pain, inflammation, and all their consequences, therefore every method and means, by which the alleviation of such symptoms, and the prevention of such consequences can be obtained, is still more necessary and requisite. Among these the posture of the limb is so principal a circumstance, that without its concurrence every other will be fruitless. The points to be aimed at are, the even position of the broken parts of the bone, and such disposition of the muscles surrounding them, as is most suitable to their wounded, lacerated state, as shall be least likely to irritate them, by keeping them on the stretch, or to produce high inflammation, and at best large suppuration. These, I say, are the ends to be pursued; and how much the position of the limb does, and must necessarily contribute to the advantage or disadvantage just recited, must be so obvious to any body capable of reflexion, that nothing more need be said about it.

At the beginning of these sheets, I have said, that it was not my intention to write a regular treatise, but only to throw out a few hints,

hints, which I hoped might prove useful to such as have not yet received better information. The part of my subject at which I am now arrived, does not indeed admit of much more: a few general precepts are all which a writer can give; the particular method of conducting each particular case, must be determined by the nature of that case, and by the judgment of the surgeon.

Every body knows, or ought to know, that these cases, of all others, require at first the most rigid observance of the antiphlogistic regimen; that pain is to be appeased and rest obtained, by anodynes; that inflammation is to be prevented or removed, by free and frequent bleeding, by keeping the body open, and by the administration of such medicines as are best known to serve such purposes.—And that, during this first state or stage, the treatment of the limb must be calculated, either for the prevention of inflammatory tumefaction, by such applications as are in general known by the title of discutients; or, such tumor and tension having already taken possession of the limb, that warm fomentation, and relaxing and emollient medicines are required.

If these, according to the particular exigence of the case, prove successful, the consequence is, either a quiet easy wound, which suppurates very moderately, and gives little or no trouble ; or a wound, attended at first with considerable inflammation, and that producing large suppuration with great discharge and troublesome formation and lodgment of matter. If on the other hand our attempts do not succeed, the consequence is gangrene and mortification.

These are the three general events or terminations of a compound fracture ; and according to these must the surgeon's conduct be regulated.

In the first instance, he has indeed nothing to do but to avoid doing mischief, either by his manner of dressing, or by disturbing the limb. Nature let alone will accomplish her own purpose ; and art has little more to do than to preserve the due position of the limb, and to take care that the dressing applied to the wound proves no impediment.

In the second stage, that of formation and lodgment of matter, in consequence of large suppuration, all a surgeon's judgment will sometimes be required in the treatment
both

both of the patient and his injured limb. Enlargement of the present wound, for the more convenient discharge of matter *; new or counter-openings for the same purpose, or for the extraction of fragments of broken or exfoliated bone, will very frequently be found necessary, and must be executed. In the doing this, care must be taken that what is requisite be done and no more, and that such requisite operations be performed with as little disturbance and pain as possible; the manner of doing business of this kind, will make a very material difference in the sufferings of the patient.

Very contrary, or at least very different intentions, seem to me to require the surgeon's very particular attention in the two parts of this stage of the disease.

Previous

* It is a practice with some, from a timidity in using a knife, to make use of bolsters and plaster-compresses for the discharge of lodging matter. Where another, or a counter-opening can conveniently and safely be made, it is always preferable; the compress sometimes acting diametrically opposite to the intention with which it is applied, and contributing to the lodgment by confining the matter; beside which, it requires a greater degree of pressure to make it efficacious, than a limb in such circumstances generally can bear.

Previous to large suppuration, or considerable collections and lodgments of matter, tumefaction, induration, and high inflammation, attended with pain, irritation, and fever, require evacuation by phlebotomy, an open belly, and antiphlogistic remedies, as well as the free use of anodynes, and such applications to the limb as may most serve the purpose of relaxation. But the matter having been formed and let out, and the pain, fever, &c. which were symptomatic thereof, having disappeared or ceased, the use and purpose of such medicines and such applications ceases also, and they ought therefore to be discontinued. By evacuation, &c. the patient's strength has necessarily (and indeed properly) been reduced; by cataplasm, &c. the parts have been so relaxed as to procure an abatement or cessation of inflammation, a subsidence of tumefaction, and the establishment of a free suppuration; but these ends once fairly and fully answered, another intention arises, which regards the safety and well-doing of the patient, nearly, if not full as much as the former, which intention will be necessarily frustrated by pursuing the method hitherto followed. The patient now will require
 refec-tion

refection and support, as much as he before stood in need of reduction; and the limb, whose indurated and inflamed state hitherto required the emollient and relaxing pul-tice, will now be hurt by such kind of ap-plication, and stand in need of such as are endued with contrary qualities, or at least such as shall not continue to relax. Good light easily-digested nutriment, and the Pe-ruvian bark, will best answer the purpose of internals; the discontinuation of the cata-plasms, and the application of medicines of the corroborating kind, are as necessary with regard to externals *.

In short, if there be any rationale in the use of the cataplasm in the first stage, its impropriety in the second must be evident from the same principles. So also with re-gard to evacuation, and the antiphlogistic regimen,

* It is surprising how large and how disagreeable a dis-charge will be made for a considerable length of time, in some instances, from the detention and irritation of a splinter of bone. If therefore such discharge be made, and there be neither sinus nor lodgment to account for it, and all other circumstances are favourable, examination should always be made, in order to know whether such cause does not exist, and if it does, it must be gently and carefully removed.

regimen, when all the good proposed to be obtained by them has been received, a pursuit of the same method must become injurious, and that for the same reason why it was before necessary and beneficial.

A non-attention to this, has, I believe, been not infrequently the cause of the loss both of limbs and lives.

Every body who is acquainted with surgery knows, that in the case of bad compound fracture, attended with large suppuration, it sometimes happens, even under the best and most judicious treatment, that the discharge becomes too great for the patient to sustain, and that after all the fatigue, pain and discipline, which he has undergone, it becomes necessary to compound for life by the loss of the limb*. This, I say, does sometimes happen under the best and most rational treatment; but I
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* There is one circumstance relative to compound fractures, which perhaps may be deemed worth nothing; which is, that I do not remember ever to have seen it necessary to amputate a limb for a compound fracture, on account of the too great discharge, in which the fracture had been united. In all those cases, where the operation has been found necessary on account of the drain, the fracture has always been perfectly loose and disunited.

am convinced that it also is now and then the consequence of pursuing the reducing, the antiphlogistic, and the relaxing plan too far. I would therefore take the liberty seriously to advise the young practitioner, to attend diligently to his patient's pulse and general state, as well as to that of his fractured limb and wound ; and when he finds all febrile complaint at an end, and all inflammatory tumour and hardness gone, that his patient is rather languid than feverish, that his pulse is rather weak and low than hard and full, that his appetite begins to fail, and that he is inclined to sweat or purge without assignable cause, and this in consequence of a large discharge of matter from a limb which has suffered great inflammation, but which is now become rather soft and flabby than hard and tumid, that he will in such circumstances set about the support of his patient, and the strengthening of the diseased limb *totis viribus* ; in which I am from experience satisfied, he may often be successful, where it may not be generally expected that he would. At least he will have the satisfaction of having made a rational attempt ; and if he is

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obliged

obliged at last to have recourse to amputation, he will perform it, and his patient will submit to it, with less reluctance than if no such trial had been made.

I have said, that a compound fracture either unites and heals as it were by the first intention, which is the case of some of the lucky few, (and was my own ;) or it is attended with high inflammation, multiplied abscesses and large suppuration, demanding all a surgeon's attention and skill; and even then sometimes ending in the loss of limb, or life, or both; or, that all our attempts prove fruitless from the first, and gangrene and mortification are the inevitable consequence of the accident.

The two first I have already spoken to, the last only remains.

Gangrene and mortification are sometimes the inevitable consequences of the mischief done to the limb at the time that the bone is broken; or they are the consequences of the laceration of parts made by the mere protrusion of the said bone.

They are also sometimes the effect of improper or negligent treatment; of great violence used in making extension; of irritation

tion of the wounded parts, by poking after or in removing fragments or splinters of bone; of painful dressings; of improper disposition of the limb, and of the neglect of phlebotomy, anodynes, evacuation, &c. Any, or all these, are capable either of inducing such a state of inflammation as shall end in a gangrene, or of permitting the inflammation, necessarily attendant upon such accident, to terminate in the same event.

When such accident or such disease is the mere consequence of the injury done to the limb, either at the time of or by the fracture, it generally makes its appearance very early; in which case also, its progress is generally too rapid for art to check. For these reasons, when the mischief seems to be of such nature as that gangrene and mortification are most likely to ensue, no time can be spared, and the impending mischief must either be submitted to or prevented by early amputation. I have already said, that a very few hours make all the difference between probable safety and destruction. If we wait till the disease has taken possession of the limb, even in the

smallest degree, the operation will serve no purpose, but that of accelerating the patient's death. If we wait for an apparent alteration in the part, we shall have waited until all opportunity of being really serviceable is past. The disease takes possession of the cellular membrane surrounding the large blood vessels and nerves some time before it makes any appearance in the integuments, and will always be found to extend much higher in the former part, than its appearance in the latter seems to indicate. I have more than once seen the experiment made of amputating, after a gangrene has been begun, but I never saw it succeed, it has always hastened the patient's destruction.

As far therefore as my experience will enable me to judge, or as I may from thence be permitted to dictate, I would advise that such attempt should never be made; but the first opportunity having been neglected or not embraced, all the power of the chirurgic art is to be employed in assisting nature to separate the diseased part from the sound; an attempt which now and then, under particular circumstances, has

has proved successful, but which is so rarely so, as not to be much depended upon.

If the parts are so bruised and torn, that the circulation through them is rendered impracticable, or if the gangrene is the immediate effect of such mischief, the consequence of omitting amputation, and of attempting to save the limb is, as I have already observed, most frequently very early destruction: but if the gangrenous mischief be not merely and immediately the effect of the wounded state of the parts, but of high inflammation, badness of general habit, improper disposition of the limb, &c. it is sometimes in our power so to alleviate, correct, and alter these causes, as to obtain a truce with the disease, and a separation of the unsound parts from the sound. The means whereby to accomplish this end must, in the nature of things, be varied according to the producing causes or circumstances: the sanguine and bilious must be lowered and emptied; the weak and debilitated must be assisted by such medicines as will add force to the vis vitæ; and errors in the treatment of the wound or fracture must be corrected; but it is evi-

dent to common sense, that for these there is no possibility of prescribing any other than very general rules indeed. The nature and circumstances of each individual case must determine the practitioner's conduct.

In general, inflammation will require phlebotomy and an open belly, together with the neutral antiphlogistic medicines, pain and irritation will stand in need of anodynes, and the Peruvian bark, joined in some cases and at some times with those of the cooling kind, at others with the cordial, will be found necessary and useful. So also tension and induration will point out the use of fomentation and warm relaxing cataplasms, and the most soft and lenient treatment and dressing. But there are two parts of the treatment of this kind of case mentioned by the generality of writers, which I cannot think of as they seem to have done. One is, the use of stimulating antiseptic applications to the wound; the other is, what is commonly called scarification of the limb. (Let it be remarked, that I speak of both these, as prescribed and practised while the gangrene is forming,

as it were, and the parts are by no means mortified.) While the inflammatory tension subsists, alleviation of pain, and relaxation of the wounded and swollen parts, in order to obtain a suppuration, and consequently a separation, seem to constitute the intention, which ought to be pursued upon the most rational principles: warm irritating tinctures of myrrh, aloes and euphorbium; mixtures of tinct. myrrh. with mel *Ægyptiac.* and such kind of medicines, which are found to be frequently ordered, and indeed are frequently used, particularly in compound fractures produced by gunshot, seem to me to be very opposite to such intention, and very little likely to produce or to contribute to the one thing which ought to be aimed at, I mean the establishment of a kindly suppuration. I know what is said, in answer to this, viz. that such kind of stimulus assists nature in throwing off the diseased parts: but this is a kind of language, which I believe will be found upon examination to have been first used without any sufficient or good ground, and to have been echoed ever since upon trust. It had its foundation in the opinion

that gunshot wounds were poisonous, and that the mortification in them was the effect of fire, and it has been continued ever since, to the great detriment of many a sufferer. A gunshot wound, whether with or without fracture, is a wound accompanied with the highest degree of contusion, and with some degree of laceration, and every greatly contused and lacerated wound requires the same kind of treatment which a gunshot wound does, as far as regards the soft parts. The intention in both ought to be to appease pain, irritation, and inflammation, to relax the indurated, and to unload the swollen parts, and by such means to procure a kindly suppuration, the consequence of which must be, a separation of the diseased parts from the sound. Now whether this is likely to be best and soonest accomplished by such dressings and such applications as heat and stimulate, and render the parts to which they are applied crisp and rigid, may fairly be left to common sense to determine.

Scarification, in the manner and at the time in which it is generally ordered and performed, has never appeared to me to
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have served any one good purpose. When the parts are really mortified, incisions made of sufficient depth will give discharge to a quantity of acrid and offensive ichor; will let out the confined air, which is the effect of putrefaction, and thereby will contribute to unloading the whole limb; and they will also make way for the application of proper dressings.—But while a gangrene is impending, that is, while the parts are in the highest state of inflammation, what the benefit can be which is supposed or expected to proceed from scratching the surface of the skin with a lancet, I never could imagine; nor, though I have often seen it practised, do I remember ever to have seen any real benefit from it. If the skin be still sound and of quick sensation, the scratching it in this superficial manner is painful, and adds to the inflamed state of it; if it be not sound, but quite altered, such superficial incision can do no possible service; both the sanies and the imprisoned air are beneath the *membrana adiposa*, and merely scratching the skin in the superficial manner in which it is generally done, will not reach to, or discharge either.

From

From what has been said, it will appear, that there are three points of time, or three stages of a bad compound fracture, in which amputation of the limb may be necessary and right, and these three points of time are so limited, that a good deal of the hazard or safety of the operation depends on the observance or non-observance of them.

The first is immediately after the accident, before inflammation has taken possession of the parts. If this opportunity be neglected or not embraced, the consequence is either a gangrene or a large suppuration with formation and lodgment of matter. If the former of these be the case, the operation ought never to be thought of, till there is a perfect and absolute separation of the mortified parts. If the latter, no man can possibly propose the removal of a limb, until it be found by sufficient trial, that there is no prospect of obtaining a cure without, and that by not performing the operation, the patient's strength and life will be exhausted by the discharge. When this becomes the hazard, the sooner amputation is performed the better. In the first instance, the operation ought to take place before inflam-

inflammatory mischief is incurred; in the second, we are to wait for a kind of crisis of such inflammation; in the third, the proportional strength and state of the patient, compared with the discharge and the state of the fracture, must form our determination.

Of

Of DISLOCATIONS in general.

THE principle inculcated so frequently in some of the foregoing pages, concerning the extended or relaxed, that is, the resistant or non-resistant state of the muscles, as depending on the position of the limb, may be applied with equal truth and equal advantage to dislocations, as to fractures. Neither of them can indeed be rightly understood or judiciously treated without such consideration. In both, a perfect knowledge of the disposition, force, attachments and uses of the muscles, at least those of the limbs, are absolutely and indispensably necessary; and if the young students would be careful in attending to the plain and obvious parts of anatomy; if they would with their own hands dissect the muscles, tendons, blood-vessels and nerves; if they would examine minutely the structure, dispositions and connexions of all the parts

parts which form the various joints, with their ligaments, and attend to the effects which the actions of the muscles and tendons connected therewith must necessarily have on them, they would have much more precise and adequate ideas of luxations, than many of them have; they would have ideas of their own, not taken upon trust from writers, who have for ages done little more than copy each other, and they would act with much more satisfaction to themselves.

By what our forefathers have said on the subject of luxations, and by the descriptions and figures which they have left us of the means they used, of what they call their *organa* and *machinemata*, it is plain that force was their object, and that whatever purposes were aimed at or executed by these instruments or machines, were aimed at and executed principally by violence.

Many, or most of them indeed, are much more calculated to pull a man's joints asunder, than to set them to rights. I will not go so far as to say, that they are all equally bad or improper; but I will venture to affirm, that hardly any of them are so contrived as to execute the purpose for which they

they should be used, in the manner most agreeable, or most adapted to the nature or mechanism of the parts on which they are to operate, or to accomplish such purpose in the most easy and most practicable manner, and consequently, as I have already said, they act by force principally.

Nor is that all; some of them labour under another defect, and that capable of producing great mischief; which is, that the force or power of the instrument is not always determinable, as to degree, by the operator, and consequently may do too little or too much, according to different circumstances in the case, or more or less caution or rashness in the surgeon.

I know very well that many of these are now laid aside, and that some few have been so altered, as to become useful; but still the same kind of principle, on which these instruments were originally founded and constructed, very generally prevails, and violence is used, to the great fatigue, pain, and inconvenience of the patient, in many cases, in which dexterity, joined to a knowledge of the parts, would execute the same purpose with facility and ease.

In dislocations, as in fractures, our great attention ought to be paid to the muscles belonging to the part affected. These are the moving powers, and by these the joints as well as other moveable parts are put into action: while the parts to be moved are in right order and disposition, their actions will be regular and just, and generally determinable by the will of the agent, (at least in what are called voluntary motions); but when the said parts are disturbed from that order and disposition, the action or power of the muscles does not therefore cease, far from it, they still continue to exert themselves occasionally, but instead of producing regular motions, at the will of the agent, they pull and distort the parts they are attached to, and which by being displaced cannot perform the functions for which they were designed.

From hence, and from hence principally, arise the trouble and difficulty which attend the reduction of luxated joints. The mere bones composing the articulations, or the mere connecting ligaments, would in general afford very little opposition, and the replacing the dislocation would require very little trouble or force, was it not for the re-

sistance of the muscles and tendons attached to and connected with them : for by examining the fresh joints of the human body, we shall find that they not only are all moved by muscles and tendons, but also, that although what are called the ligaments of the joints do really connect and hold them together, in such manner as could not well be executed without them, yet, in many instances they are, when stript of all connection, so very weak and lax, and so dilatable and distractile, that they do little more than connect the bones and retain the synovia ; and that the strength as well as the motion of the joints, depends in great measure on the muscles and tendons connected with and passing over them ; and this in those articulations which are designed for the greatest quantity, as well as the celerity of motion. Hence it must follow, that as the figure, mobility, action, and strength of the principal joints depend so much more on the muscles and tendons in connexion with them, than on their mere ligaments ; that the former are the parts which require our first and greatest regard, these being the parts which will necessarily oppose us in our attempts

for reduction, and whose resistance must be either eluded or overcome: terms of very different import, and which every practitioner ought to be well apprised of.

From the same examination is to be obtained a kind and degree of very useful information, which the skeleton cannot afford. I mean an acquaintance with the ligaments themselves both external and internal, the cartilages both fixed and moveable, and the parts furnishing what is called the synovia.

This to those who are perfectly acquainted with the subject, may seem too obvious to have needed mention; but no one who has not examined the joints can possibly have this kind of necessary knowledge, and I am convinced that there are many practitioners who have no idea of articulations, but what the assemblage of dry bones has furnished them, and which must be very inadequate.

I have neither leisure nor inclination at present to enter into this matter minutely, or indeed as it deserves; beside which, I have, I fear, sufficiently exercised my reader's patience already in the foregoing sheets.

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I will therefore detain him no longer than while I mention a few leading principles relative to luxations in general, drawn from the structure of the parts concerned, and which appear to me to be applicable, with very little if any variation, to every particular species.

1. Although a joint may have been luxated by means of considerable violence, it does by no means follow, that the same degree of violence is necessary for its reduction.

2. When a joint has been luxated, at least one of the bones of which it is composed is detained in that its unnatural situation, by the action of some of the muscular parts in connexion with it; which action, by the immobility of the joint, becomes, as it were, tonic, and is not under the direction of the will of the patient.

3. That the mere burfal ligaments of some of the joints endued with great mobility are weak, distractile, and constantly moistened; that for these reasons they are capable of suffering considerable violence without being lacerated; but that they are also sometimes most certainly torn.

4. That

4. That did the laceration of the said ligaments happen much more frequently than I believe it does, yet it cannot be a matter of very great consequence, as it neither totally prevents reduction, when timely and proper attempted, nor a consequent cure *.

5. That

* In the accident of a dislocated tibia, from a broken fibula, the strong, inelastic, tendinous ligaments, which fasten the end of the former bone to the astragalus and os calcis, are frequently torn; and as these by proper care almost always do well and recover all their strength, there is the greatest reason to expect, that the more weak, distractile ones do the same. The only mischief which seems most likely to follow from a laceration of the latter is, from an effusion of the synovia; of which, I think I have (in a bad habit) seen an instance in the joint of the ankle. That the laceration of the bursal ligament of the shoulder cannot be a frequent or general impediment to reduction appears to me, from my never having in more than twenty years care of an hospital, met with a single instance of its impracticability, when attempted in time.

For it can hardly be supposed, that such kind of accident should never have fallen to my lot, or to the people who have acted under me.

But even if this could be supposed, I can also say, that I do not remember impossibility of reduction to have

5. That supposing such accident to be frequent, yet as it is impossible to know, with any kind of certainty, whether it has happened or not, or in what part of the ligament, it cannot be admitted as a rule for our conduct, nor ought such mere conjecture to produce any deviation from what we ought to do, were there no such supposition. Could we know with certainty when and where this had happened, very useful information might indeed be drawn from it.

6. That all the force used in reducing a luxated bone, be it more or less, be it by hands, towels, ligatures or machines, ought always to be applied to the other extremity of the said bone, and as much as possible to that only.

In every joint capable of dislocation, the same circumstance which renders it liable to be displaced, is also a very considerable assistance in its reduction. I mean the dilatability or distractile power of the ligaments, their capacity of giving way when stretched or pulled at.

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happened to any of the other gentlemen of the house, under the same circumstances.

This is perhaps the strongest argument which can be produced, why all the force made use of in reducing a dislocated joint should be applied to that bone only, and not to the next. By the yielding nature of the ligaments of the luxated joint, reduction is to be accomplished. The ligaments of the other articulation, which is not luxated are yielding also ; and all the force which is applied to the bone below or adjoining, must necessarily be lost in the articulation which is not luxated, and can be of little or no service in that which is.

Let this principle be applied to the dislocation of the joint of the shoulder, and it will shew us why the ambi, in which the whole arm is tied down, and subjected to the extending power of the said instrument, is defective, and may be pernicious. Why instruments built on the same general principle, but in which the fore-arm is not fastened down, but left at liberty and not subjected to the ligature, execute their purpose with a great deal less force. Why the vulgar but frequently very successful method of reducing this joint, by placing the operator's heel in the axilla of the supine patient, sometimes fails, the surgeon not

having proper assistance, and contenting himself with pulling at the patient's wrist only. It will also shew us, why in the case of a luxated os femoris at the joint of the hip, the strength of five or six people divided between the joint of the knee and that of the ankle, shall be insufficient, and that of four, nay three of the same assistants shall in the same case prove sufficient, by being all, and properly applied to the knee and femur only, as I have more than once seen.

Many other applications of this principle might be made, but these are sufficient to those who understand the principle itself and see its force.

7. That in the reduction of such joints, as are composed of a round head, received into a socket, such as those of the shoulder and hip, the whole body should be kept as steady as possible, for the same reason as in the foregoing.

8. That in order to make use of an extending force with all possible advantage, and to excite thereby the least pain and inconvenience, it is necessary that all parts serving to the motion of the dislocated joint, or in any degree connected with it, be put
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into such a state as to give the smallest possible degree of resistance.

This I take to be the first and great principle by which a surgeon ought to regulate his conduct in reducing luxations. This will shew us why a knowledge of all the muscular and tendinous parts, acting upon, or in connexion with the articulations, is absolutely necessary for him who would do his business scientifically, with satisfaction to himself or with ease to his patient. It will shew us, that the mere position of the limb below the luxated joint, is what must either relax or make tense the parts in connexion with that joint, and consequently that posture is more than half of the business. It will shew us, why sometimes the luxated os humeri slips in, as it were, of its own accord, by merely changing the position of the arm, when very violent attempts, previous to this, have proved unsuccessful. It will shew us why extending the arm in a straight line horizontally, or so as to make a right angle with the body, must in some instances, render all moderate attempts fruitless. Why the method of attempting reduction by the heel in the axilla is so often successful, notwithstanding two

very considerable disadvantages under which it labours, viz. part of the force being lost in the elbow, and the tense state of one head of the biceps cubiti. Why the tying down the fore-arm in the common ambi is wrong, for the same reasons. Why the fore-arm should at all times (let the method of reduction be what it may) be bent, viz. because of the resistance of the long head of the biceps in an extended posture. Why when the os humeri is luxated forward, or so that its head lies under the great pectoral muscle, the carrying the extended arm backward, so as to put that muscle on the stretch, renders the reduction very difficult, and why, on the contrary, the bringing the arm forward, so as to relax the said muscle, removes that difficulty, and renders reduction easy. Why the reduction of a luxated elbow should always be attempted by bending the said joint. Why, when the inner ankle is dislocated in consequence of a fracture of the fibula, it is extremely difficult at all times, and sometimes impracticable, either to reduce or to keep reduced the said joint, while the leg is in an extended posture; and why a bent posture of the leg enables us with ease to accomplish both

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those ends. Why in the case of dislocation of the head of the os femoris, (be it in what manner it may) a straight position of the leg and thigh will always increase the difficulty of reduction; and why that very distorted and bent disposition, in which the patient will always place it for his own ease, is and must be the posture most favourable for reduction; because it is and must be that posture in which the muscles, most likely to make opposition, are most relaxed and rendered least capable of resistance*.

9. That in the reduction of such joints as consist of a round head, moving in an acetabulum or socket, no attempt ought to be made for replacing the said head, until it

* In the attempts for reduction of a luxated hip, there is one circumstance, which by being overlooked, or not attended to, has more than once rendered every effort vain.

It is usual and indeed necessary to tie down and confine the patient on a bed or table, in order to keep his body firm and steady; one part of the bandage or strapping by which he is confined is fixed in the groin, and passing over his belly and under his buttock, is fastened above or rather beyond his head to something immovable. If this bandage be placed (as I have seen it) in the groin on the side of the luxated bone, it will prove so far from being assistant, that it will necessarily frustrate every attempt.

it has by extension been brought forth from the place where it is, and nearly to a level with the said socket.

This will shew us another fault in the common ambi, and why that kind of ambi, which Mr. Freke called his commander, is a much better instrument than any of them, or indeed than all; because it is a lever joined to an extensor; and that capable of being used with the arm, in such position as to require the least extension, and to admit the most; beside which it is graduated, and therefore perfectly under the dominion of the operator.

It will shew us, why the old method by the door or ladder, sometimes produced a fracture of the neck of the scapula; as I have seen it do in our own time.

Why if a sufficient degree of extension be not made, the towel over the surgeon's shoulder, and under the patient's axilla, must prove an impediment rather than an assistance, by thrusting the head of the humerus under the neck of the scapula, instead of directing it into its socket.

Why the bar or rolling-pin under the axilla produce the same effect.

Why

Why the common method of bending the arm (that is, the os humeri) downward, before sufficient extension has been made, prevents the very thing aimed at; by pushing the head of the bone under the scapula, which the continuation of the extension for a few seconds only would have carried into its proper place.

I know it is said, that mere extension only draws the head of the bone out from the axilla, in which it was lodged, but does not replace it in the acetabulum scapulæ. To which I will venture to answer, that when the head of the os humeri is drawn forth from the axilla, and brought to a level with the cup of the scapula, it must be a very great and very unnecessary addition of extending force, that will or can keep it from going into it. All that the surgeon has to do, is to bring it to such level; the muscles attached to the bone will do the rest for him, and that whether he will or not.

Indeed if all the rational means and methods for reducing a luxated shoulder be examined, they will be found to act upon this principle, however differently this matter may appear to those who have not attended

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ed to it. Even the common ambi succeeds by means of the extension, which the carrying the arm down with it produces, and not by its lever. That part of the instrument, so far from helping, is often a considerable hindrance, and even sometimes frustrates the operator's intention, by pushing the head of the bone against the scapula, before it is sufficiently drawn out from the axilla.

If it was necessary to add any thing in support of this doctrine, I should say, that the supposition of laceration of the burfal ligament, being a circumstance frequently attending this luxation, and proving an impediment to reduction, is a strong inducement to us to be always attentive to the making such extension, it being much more likely that the head of the bone should return back by the same rent in the ligament, when such ligament is moderately stretched out, than when it may be supposed to lie wrinkled or in folds.

10. The last principle which I shall take the liberty to mention, and which I would inculcate very seriously is, that whatever kind or degree of force may be found necessary for the reduction of a luxated joint,
that

that such force be employed gradually ; that the lesser degree be always first tried, and that it be increased gradatim.

Whoever reflects on what is intended by extension, what the parts are which resist, and how that resistance may be best overcome, will want little argument to induce him to accede to this principle ; the advantages deducible from attending to it, and the disadvantages which may and do follow the neglect of it, are so obvious.

They who have not made the experiment will not believe to how great a degree a gradually increased extension may be carried without any injury to the parts extended ; whereas great force, exerted hastily, is productive of very terrible and very lasting mischief.

I know that the *vis percussio*nis, as it is called, has been recommended, as having been successful in some difficult luxations ; but I have seen such bad consequences from it, that I cannot help bearing my testimony against it. The extensile and distractile quality of the membranes, muscles and ligaments, enables them to bear the application of very great force to them, without hurt, if such force be applied gradually,
and

and proper time be allowed for the parts to give way in ; but great force, suddenly applied, is capable of producing the most mischievous consequences ; and that in many other parts of surgery, beside what relates to luxations,

F I N I S.

